POPULAR SCIENCE

MONTHLY

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PAGE 94

December, 1950 • 25¢

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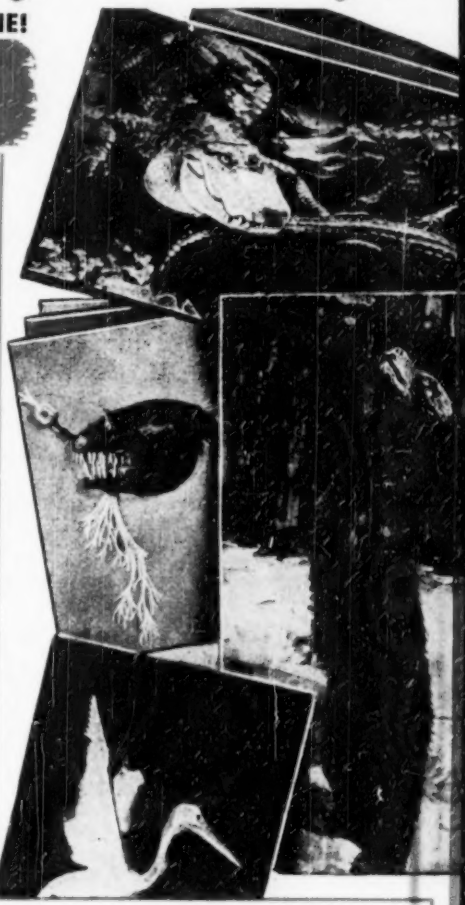
THE YOUNG OF THE OPOSSUM are so small at birth that a litter of sixteen easily fits into a tablespoon!

HITCHHIKER OF THE HIGH SEAS is the sharksucker, a fish that attaches itself to the body of a larger fish or sea turtle and rides unmolested on the abdomen of its powerful companion.

These are just a few of the thousands of interesting phenomena of wild life described in this book.



Here is a Partial List of the Wild Life Subjects Covered in This Superb Volume

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Whales
Dolphins and Porpoises
Mountain Sheep
Mountain Goat
Bison
Pronghorn Antelope
Caribou, Moose
Deer, Rabbits
Mountain Beaver
Muskrat, Beaver
Woodchuck
Prairie-Dog
Sea-Lions
Cougar, Fox
Coyote, Wolf
Badger, Skunk
Otters, Raccoon
Bears

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Nuthatches, Wren
Warblers
Shrike, Swallows
Tanager
Starling, Crows
Fly-catchers
Hummingbird
Woodpeckers
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Roadrunner
Parrot
Eagles, Hawks
Turkey, Grouse
Quails and Bob-Whites
Cranes, Herons
Spoonbills
Geese, Swans
Cormorants
Albatross, Gulls

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Alligator
Crocodile
Lizards, Turtles
Terrapins
Tortoises

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Siren, Newts
Mud-Puppy
Congo Eel
Mole Salamander

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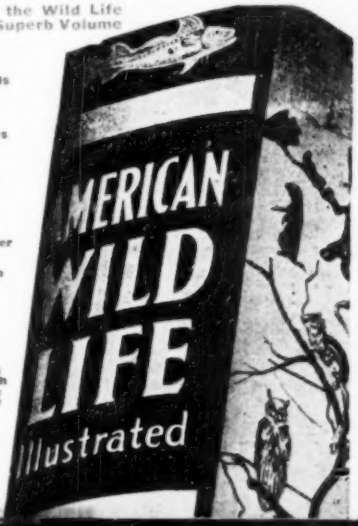
Trout, Sharks
Rays



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Portable Rack for Home Tools

GOVERNMENT experts have listed the tools most often needed to maintain an American home. You'll find them all pictured in POPULAR SCIENCE next month, along with tips on taking care of them, and directions for making an inexpensive, portable rack.

Whether you are a beginner or an old hand at taking care of a house, you'll find this article helpful. Watch for it next month.

Testing for sound lost between telephone receiver and ear. Many subjects were used in these tests.

How to compensate for a curl . . . and add to your telephone value

Bell scientists know that the telephone is not used under ideal laboratory conditions. There is never a perfect seal between receiver and user's ear. A curl may get in the way, or the hand relax a trifle. And ears come in many shapes and sizes. So some sound escapes.

Now, sound costs money. To deliver more of it to your ear means bigger wires, more amplifiers. So Bell Laboratories engineers, intent on a thrifty telephone plant, must know how much sound reaches the ear, how much leaks away. They mounted a narrow "sampling tube" on an ordinary handset. The tube extended through the receiver cap into the ear canal. As sounds of many frequencies were sent through the receiver, the tube picked up a portion, and sent it through a condenser microphone to an amplifier. That sampling showed what the ear received.

As a result, Bell scientists can compensate in advance for sound losses—build receivers that give *enough* sound, yet with no waste. That makes telephone listening always easy and pleasant.

It's another example of the way Bell Telephone Laboratories work to keep your telephone service one of today's biggest bargains.

Automatic recorder plots sound pressures developed in the ear canal at different frequencies.

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THOUGHTS HAVE WINGS

You Can Influence Others With Your Thinking!

TRY IT SOME TIME. Concentrate intently upon another person seated in a room with you, without his noticing it. Observe him gradually become restless and finally turn and look in your direction. Simple—yet it is *a positive demonstration* that thought generates a mental energy which can be projected from your mind to the consciousness of another. Do you realize how much of your success and happiness in life depend upon your influencing others? Is it not important to you to have others understand your point of view—to be receptive to your proposals?

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Scribe W. W. A., The Rosicrucians, AMORC, Rosicrucian Park, San Jose, California.

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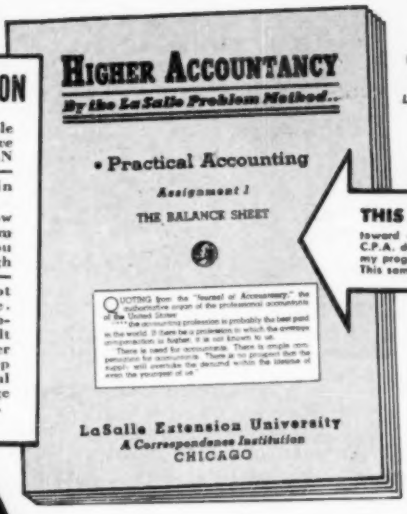

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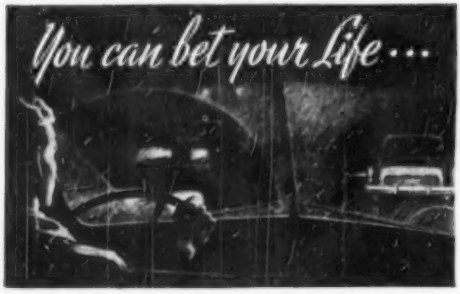

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Letters

Too Good to Lose

Sir:

I followed all the instructions in your September article [p. 207] on upping my car's value to get a better price. But—when

I finished, the car looked so good I decided to keep it.

AL AARON

Washington, D.C.

Lineup Unchanged

Sir:

One of the TV snapshots in your October issue, page 128, is a baseball action picture that—you say—shows the Brooklyn Dodgers playing the Cleveland Indians. Since those two teams are in different leagues, how could they meet—except in a World Series? You must have meant the Dodgers against the Boston Braves.

ALVIN MILLER

Boston, Mass.

Nope, Indians is right. The picture was taken during the telecast of a night exhibition game at Ebbets Field on July 24. The Brooklyns won, 6-4.

Speed vs. Space

Sir:

I can't agree with B. J. Stephenson's suggestion in your Letters column for October [p. 14] for reducing highway accidents by requiring that all cars have engine governors set at the legal speed limit. Granted that excessive speed causes most accidents, still a little extra power for sudden acceleration is handy for getting out of someone's way in an emergency.

A better idea might be to require all persons getting driver's licenses to go out on a highway or special track and see for

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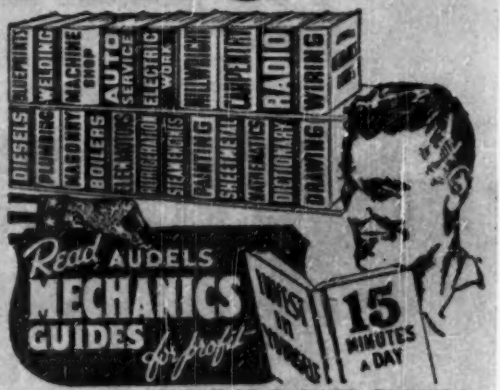

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themselves how much space it takes to stop a car at various speeds.

ROBERT L. WEBBER

Berkeley, Calif.

Scoreless Wrenches

Sir:

Here's a stunt I pulled that might be helpful to other PS readers:

To keep wrenches from scoring tubing and pipe, especially the chrome-plated parts of brass plumbing fixtures, I wrap the jaws with three or four thicknesses of friction tape. This gives a fine grip and leaves no scars.

A. C. WHITE

Savannah, Ga.

Shocking Situation

Sir:

Especially in winter, I suffer many shocking experiences from static electricity in my car. It was bad before I put on plastic seat covers, and worse afterward. After sliding into the car, I get a shock from the ignition key. Then I drive a while, slide out, and get another from the door. The shocks aren't dangerous, but they do sting.

What can I do to stop them?

CONRAD BALLIET

Drums, Pa.

Dangling chains or special conductive tires are common ways to drain static charges off

vehicles. These probably wouldn't help you, since your trouble seems to be a potential between you and the car. Try holding on a door handle while you slide in or out, to keep the potential from building up.

Early Super-Movie

Sir:

You featured in your August issue [p. 74] an article about Super-Movies. This projection system is more than 22 years old and has been shown in Europe. . . .

I worked on the synchronization of three

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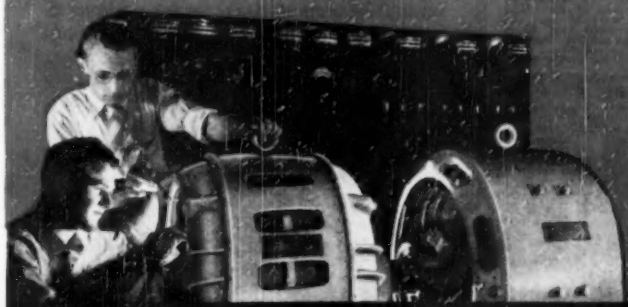
IN ELECTRICITY

On Real:



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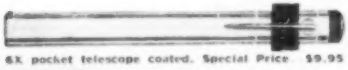

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projectors for the showing of a French film, "Napoleon," in 1928 at the Ufa Palace in Berlin, Germany. This film had a tremendous success, but the extremely high cost of this system prevented further application. . . .

ALFRED R. STAHL

Garnet Lake, N.Y.

Laurels to pioneer Stahl for his early work in super-moviemaking. Rarely does any important invention resemble nothing that has gone before. Unique features claimed for the current Cinerama process: "a continuous picture on a hemicylindrical screen"; the methods of photographing and assembling it; and the extremely large 55.5° by 146.2° angle that it covers. According to inventor Fred Waller, a complete search of patents and records going back to the earliest days of movie-making has been made, and patents have been granted on the Cinerama process and its parts in many countries throughout the world.

Off His Rocker

Sir:

Wilbur Shaw, reporting on the new Nashes in your October issue [p. 105], says that one reason the '51 Statesman's engine is so quiet is that clearances of the rocker arms on their shafts has been decreased, reducing valve noise. Apparently Mr. Shaw forgot that the Statesman, formerly the "600," has an L-head motor—which does not have rocker arms and shafts.

FAY O. WOOD

Elkhart, Ind.

Right—nice catch.

Safety Tip

Sir:

Your June issue showed, on page 221, a setup to do dovetailing, with the bit mounted in a Jacobs chuck. Is it not taboo to mount this or any router bit in such a chuck?

ALGEO H. BRILL

Marysville, Calif.

It is, if the chuck is mounted by the taper alone, since side thrust may pull the chuck off with disastrous results. But there's a sound way to make the chuck safe for such work. Drill and tap a hole in the end of the spindle, run a clearance hole up

INVENTORS

Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

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through the chuck body, and secure the chuck with a screw. For full details, see PS, Sept. '46, p. 173.

Black or Blue?

Sir:

Your article on the President's new Lincoln convertible [Sept., p. 158] says the body is "coal black." The Ford company's *Lincoln-Mercury Times* printed a color photo showing it as bright blue. Who's right?

WILLIAM B. MADDOCK

Bloomfield, Ind.

The car was, and is, coal black.

Animal Business

Sir:

An article you published back in June 1949 [p. 200] on how to make circus animals from plastic got me started in a money-making business. I first made some of the animals as a hobby, and my friends liked them so much that I began turning them out in quantity to sell through local stores. Now they're selling out as fast as I can produce them.

RENE E. PITTET

Roswell, N.M.

Fancy Pants

Sir:

The photograph with the article "Car Bouncer Spots Squeaks" in your August issue, page 115, shows a car that seems to have Cadillac fenders but an Oldsmobile trunk lid. Which is it?

DANIEL DUET

Westwego, La.

The car was an Olds fancied up with special fenders to pass, at quick glance, for its more aristocratic cousin.

Now They Make It . . .

In "I'd like to see them make . . ." for October, K. M. Isbell, of Los Angeles, asked for "an automobile horn that would sound only a low-volume toot . . . but would increase in volume the harder you pressed down on the horn button."

Buell, makers of truck and bus horns, is bringing out a horn for passenger cars with variable volume control.

INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you.

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

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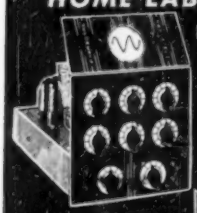

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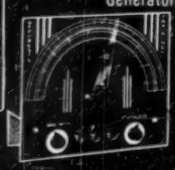

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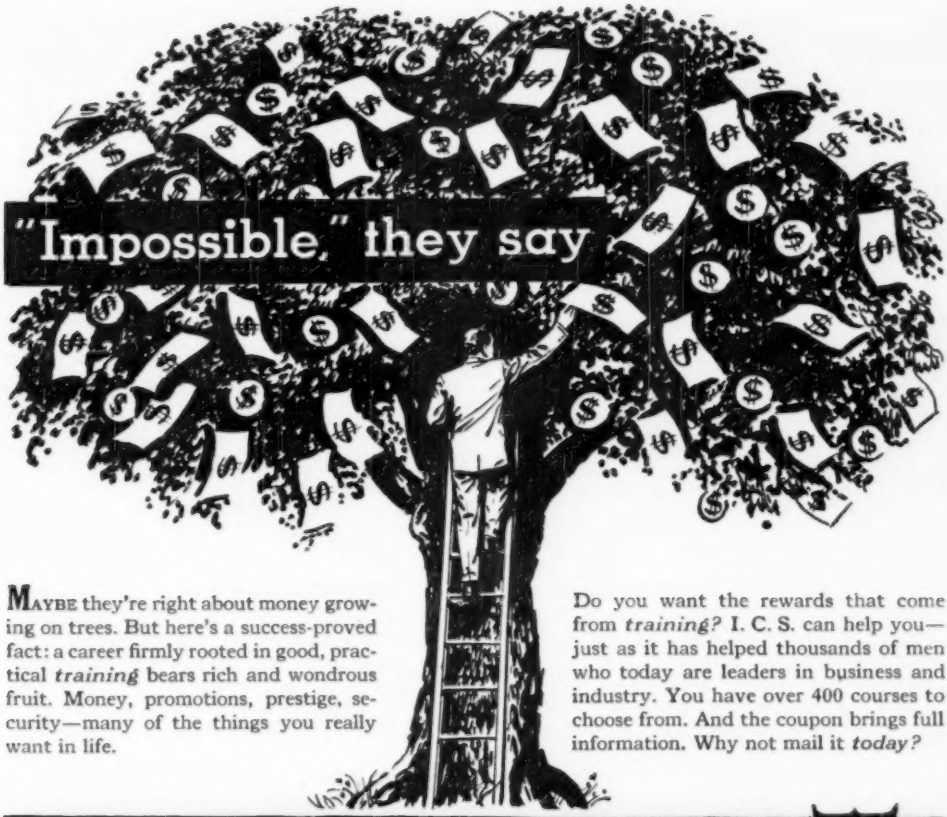

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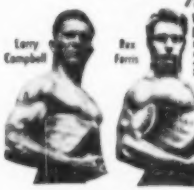

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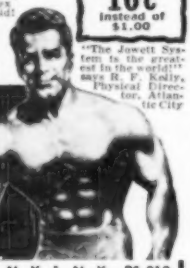

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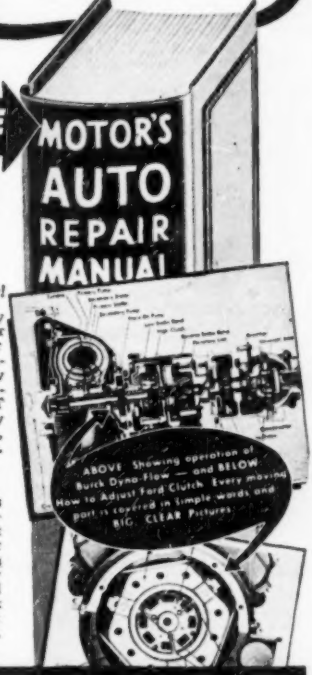

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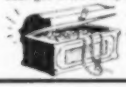

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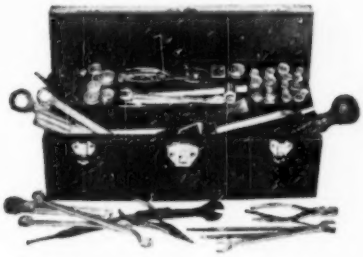

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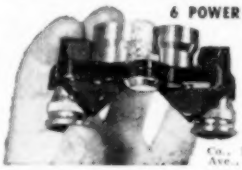

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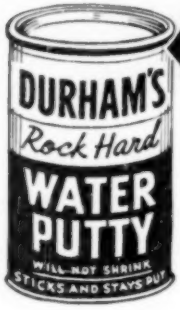

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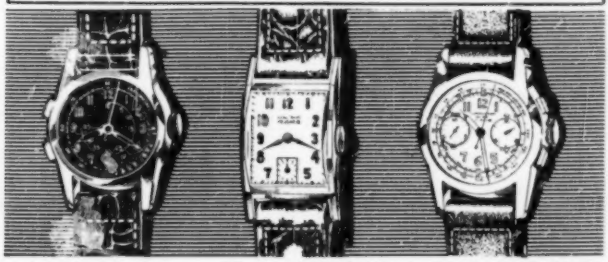

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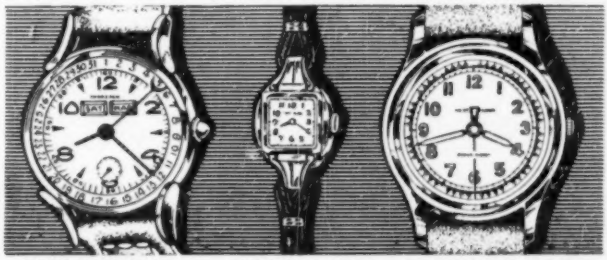

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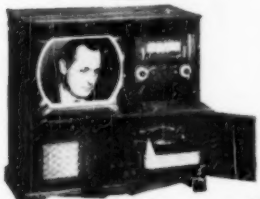

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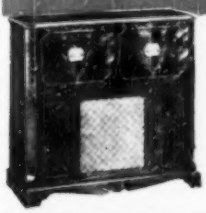

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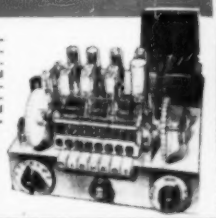

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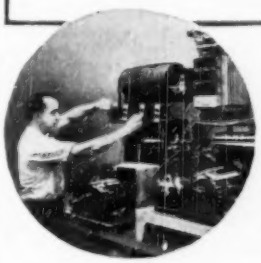

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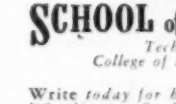

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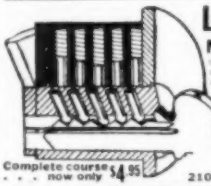

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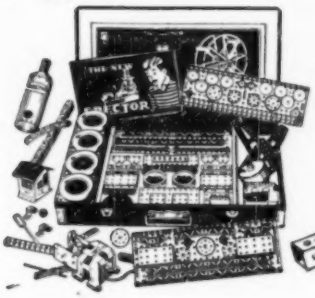

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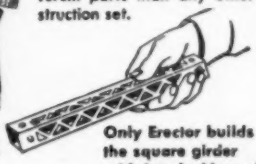

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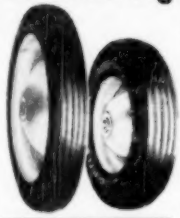

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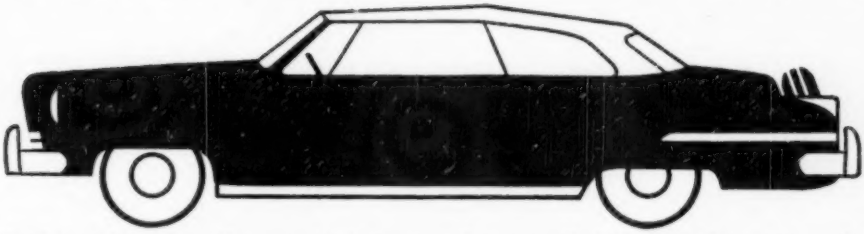

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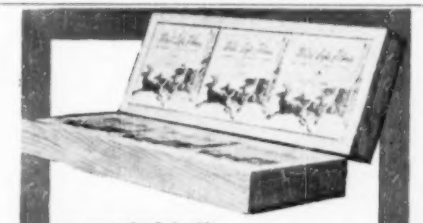

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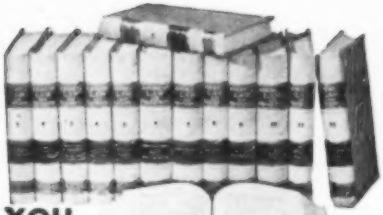

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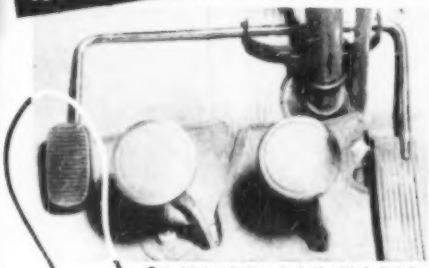

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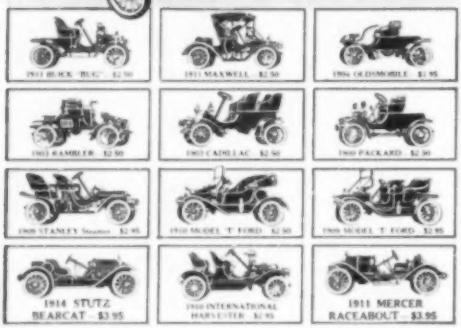

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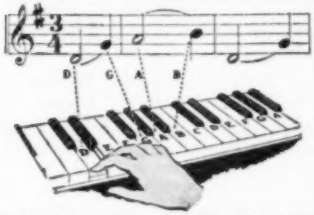

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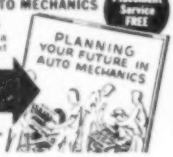

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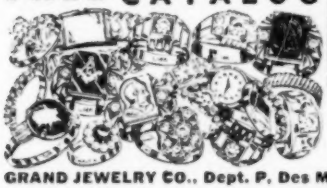

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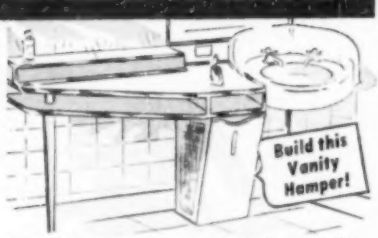

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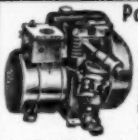

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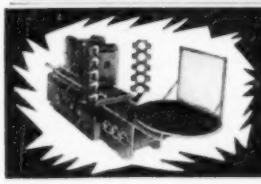

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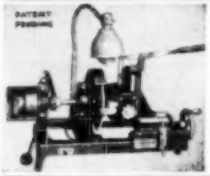

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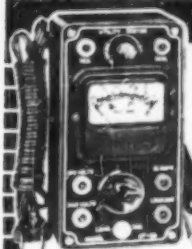

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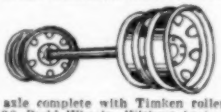

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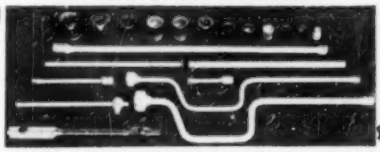

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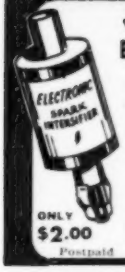

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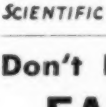

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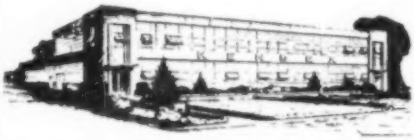

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CLEARANCE Sale of 16mm Films. Want a real buy in 16mm Sound Films? Take advantage of the I.C.S. 1951 Clearance Sale of 16mm sound Features: comedies, cartoons, novelties, musicals, new, used. Specify. Send for our giant list "A" today stating machine you own (make and model). Institutional Cinema Service, Inc., 1560-PS Broadway, New York 19, N. Y.

52 MUSIC, MUSICAL INSTRUMENTS

POPULAR Piano Lessons by mail. No musical knowledge necessary. Two new popular songs with every lesson. Play 2 songs in first lesson, or money back. Send for free details. Stuart Piano Studio, 127B Morris Ave., Union, N. J.

SWISS Musical Movements $2.50. Also wholesale (shelled). Spielman, 131 West 42nd, New York 18.

GUITAR offers Romance! Popularity! Free details, guaranteed course. National Conservatory, 1164 Chapel, New Haven 11, Connecticut.

SWISS Music Boxes $1.00. Catalog 10c. Bell Music, Box 49, Planetarium Station, New York 24, New York.

SONGWRITER—Publication Opportunity—Royalties. Abbey Music, 242 West 10th, New York 14, New York.

53 SONG WRITERS

SONGWRITERS Poems Wanted. Percentage basis collaboration. Terry Tunesmith, 22 Northwest 8th, Oklahoma City 3.

WANTED! Poems for musical settings. Write Songwriters' Service, Clifton, N. J.

POEMS Wanted to be set to music. Free examination. Send poems. McNeil, Master of Music, 510-PS, S. Alexandria, Los Angeles, California.

SONGWRITERS! Outstanding, ethical offer. Hibbeler, C-15, 2157 N. Avers, Chicago 47.

POEMS wanted for musical setting. Send poems for free examination. Five Star Music Masters, 646 Beacon Bldg., Boston, Mass.

SONGWRITERS. Opportunity for recording on royalty basis by large Recording Company with national sales distribution. Send song material. Free Examination. No charge for melody. Lead sheets, records furnished. Music Makers, Dept. F-3, Box 1989, Hollywood, California.

54 RADIOS, SUPPLIES & EQUIPMENT

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CLOSEOUT. Quitting Radio. Mammoth Box Parts, Tools Prepaid $2.00. Ervin, Box 383, Hamilton, Ohio.

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MAKE Money by mail! Write Wehner, Box 142-E-5, Roxbury 19, Mass.

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WOULD You pay 3%—first $350 made? Book "505 Odd Successful Businesses" free! Expect something odd! Pacific—PS, Oceanside, California.

FLORIDA Opportunity Bulletin—exciting new publication listing hundreds job openings, business opportunities, farms, groves, homes throughout Sunshine State. Trial subscription six issues $1.00. Florida Bulletin, Box 4674-PS, Jacksonville, Fla.

HOME Manufacturing Easy. Add Water. Etc. To Our Bases. Will Give Exclusive Franchises. Plastics. Box 1574, Boston 4, Massachusetts.

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WANTED! Home Producers by manufacturers in our Clearing House Service. Become a sub-contractor, casting plastic products for these companies. Thousands of easy to make items required. Cash in at home without previous experience. For details write Plastic Service Guild, Dept. P.S., 233 Condor St., East Boston 28, Mass.

LEARN reweaving! Free Details. Frank Harris, 4333 South Carrollton, New Orleans, Louisiana.

$46 FROM Square Foot Plywood: Jigsaw necessary. Write: Woodart, Bridgewater, Massachusetts.

CAST Figurines! Novelties! Rubber molds! Dollar each! Castcraft, 508-S Marion St., Brooklyn 33, N. Y.

$4,000.00 PROFIT in two months. No investment. Details 50c. Charles Co., 12-BPF, Norwood, Ohio.

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MAKE money by mail. Easy, big profits. Everything furnished. Write—Thomas' Service Enterprise, P.O. Box 56, Brooklyn 28, New York.

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ILLUSTRATED Catalog: Chemistry, mineralogy, biology, 10c. Tracey Laboratories, Evanston, Illinois.

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61 HELP WANTED

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FOREIGN & Latin American Employment, 1951 "Foreign Service Directory" gives Up-To-Minute Facts on Military & Civilian Construction, Government Jobs, Major Oil Listings, Aviation, Transportation, Steamship Lines, Mining, Importers, Exporters, How-When-Where to apply, application forms, Hot List Firms Hiring. $1.00 post-paid. Global Reports, P.O. Box 883-S, Hollywood 28, Calif.

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MAKE $20 a day! Sell Staybright Brass Name Plates for front doors. Write Hubstamp, 357-F Congress, Boston, Mass.

IMMEDIATE opening for 2 or 3 reliable men with car to call on farmers. No experience necessary. Steady work. $15 to $20 in a day. McNess Company, Dept. 265, Freeport, Ill.

MAN to earn $85 week and up. Long needed invention. Advertised in Saturday Evening Post. Full or part time. Exclusive Territory. No investment. Free sample outfit. Write Red Comet, Inc., Dept. 813, Littleton, Colorado.

$5 HOUR Easy! Sell name plates for houses. Free Sample, order blanks. Write: National, 214 Summer, Boston, Mass.

SELL our standard job application forms. Samples & liberal discount offer: 25c or dime for single form. Standard Forms, 1112 N.W. 18th Pl., Miami, Fla.

FOREIGN Employment Information. Directory listing 150 companies with projects or branches and application forms: $1.00 (C.O.D. $1.22). Wentworth Company, Box 3980, Miami, Fla.

62 AGENTS WANTED

FREE Complete Sales Kit. Sell personal initialed belts and buckles, cap badges, tie holders, etc. Choice of 2000 emblems. Write for free selling outfit today. Hook-Fast, Box 1425PS, Providence, Rhode Island.

"FOG-STOP" Windshield Cloth. Instantly removes blurry Mist, Frost, Sleet, Snow. Stops windshield fogging. Samples sent on trial. Kristee 161, Akron, Ohio.

STRANGE "Dry" Window Cleaner. Sells like wild. Replaces messy rags, liquids. Simply glide over glass. Samples sent on trial. Kristee 160, Akron, Ohio.

UP to $50.00 in a week and tailored suit for yourself without paying one cent. Write for plan. Progress Tailoring Co., Dept. M-221, Congress & Throop, Chicago 7, Ill.

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WIN Suits And Earn Money! Both easy with amazing plan. Show finest made-to-measure tailoring to friends, neighbors. No experience or investment. Free outfit. Write Stonefield Corp., 532 S. Throop, Dept. M-821, Chicago 7, Ill.

SELL Ultra-blue stock signs to stores. 1000 slogans, comedy, general, religious. 7" x 11" cost 6c, sells 35c. Make money. 15 samples $1.00 postpaid. Lowy, 812 Broadway, Dept. 580, New York.

BIG Money Fast Hot Items. National Distributing Co., Calumet Bldg., Miami, Florida.

WOMEN Who Can Sew And Alter dresses, make extra money part time taking orders for big manufacturer. All sizes. Amazing values. Everything furnished. Harford Frocks, Dept. D-135, Cincinnati 25, Ohio.

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TO $35.00 Weekly Spare Time Home Operated Mail Order Business. Successful Small "Beginner's" Plan. Everything Supplied. Free Details. Lynn, 5710-C Bankfield, Culver City, California.

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PERFUME—Sideline to Independence. Learn All—Free—"International". 6347 Parnell—PA-12, Chicago 21, Illinois.

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WATCHMAKERS! Beginners! Watches; Movements, Descriptive List 15c. Box 150, Chicago 90.

REPAIRS Materials Tools, Supplies, Watches, Jewelry Catalog. Gales, Box 1000, Chicago.

WATCHES Repaired, $2.50. Guaranteed! Send For Confidential Trade Repair Prices. National Watch Repair, Box 2414-EB, Cleveland 12, Ohio.

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BEFORE

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700-16	5.96	700-15	6.56	700-20	10.96	1100-20	17.56
750-16	6.96	710-15	6.36	32x6 (8)	10.[illegible]	1200-20	18.56
550-17	5.96	760-15	6.56	32x6 (10)	11.96	1000-22	15.56
525-18	5.56	820-15	7.06	750-20	12.56	1100-22	17.56
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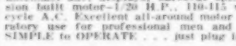

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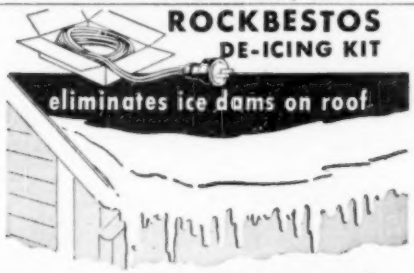

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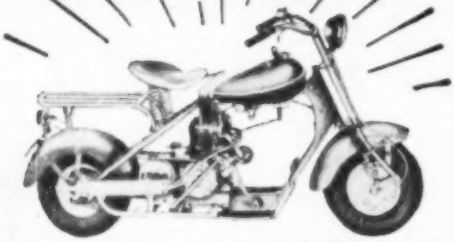

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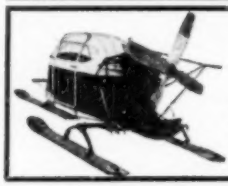

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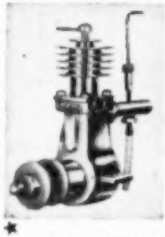

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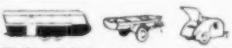

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Kits furnished with all necessary material for perfect installation. No outside mounting of any kind. Uses your present parking and tail lights. Either of our two models fits most cars from 1942 to 1950.

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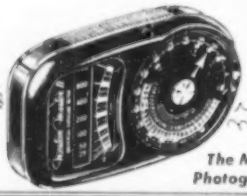

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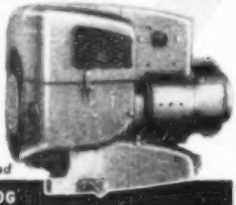

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BE A CHAMPION DRIVER

. . . Keep Plugs Clean for Winter Starting!

Most service calls in winter involve cars that won't start. Dirt and oil accumulations on spark plug insulators often short circuit plugs under cold, damp conditions. Be sure to wipe off insulators frequently.

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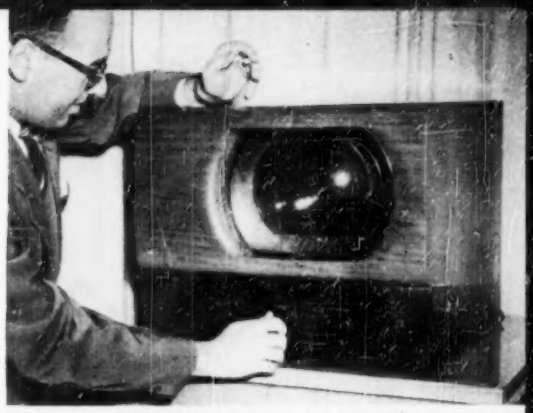
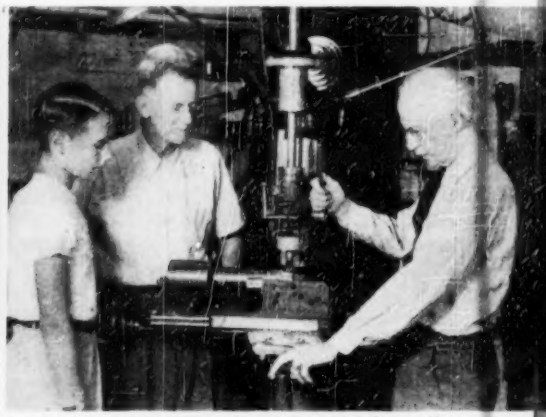
Choice, crimp cut, mild, flavorful tobacco—all ready for Christmas in a colorful, gift-packed Yuletide package . . . with a built-in gift card right on top!

Popular Science *Highlights* this Month

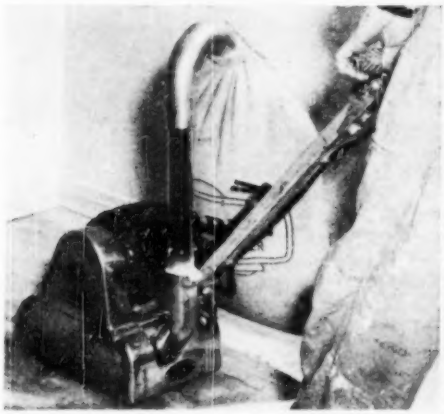


Are You Confused About Color Television? Then this low-down will help clear away the debris of TV's recent bombshell. **Page 116**

Outdoor Lights Spell Merry Christmas. This spotlighted Santa may be all you need, but if you want to get fancy, here's how. **Page 161**



Uncle Sam Can Use Your Workshop. Here's a call to the basement bench-and-lathe brigade to help industry re-arm America. **Page 186**

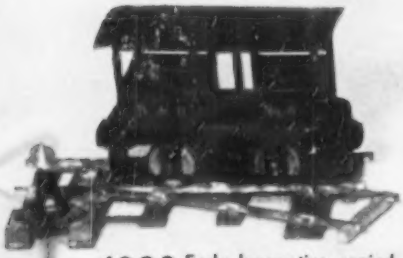


Make Your Floors Look Like New. Follow these know-how tips, using rented machines, and you'll do a professional refinishing job. **Page 170**

It's Gas, Not Beer. Those barrels are filled with LPG, a butane-propane mixture that's got more sass than high-octane. **Page 150**

1900

Granddaddy of all toy electric trains, with motor beneath car at right, drew current from track of metal strips set in wooden ties.

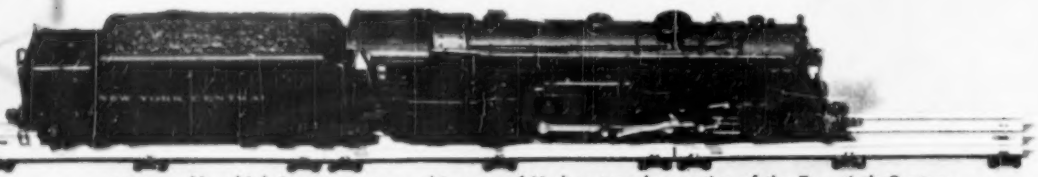


50th Christmas

1903 Early locomotive copied pioneer electric type of B&O.

1907 Large size of this toy train's engine and cars was typical of period. Train ran "on four good dry batteries," along "standard" three-rail track of wide 2⅛-in. gauge.

1915 Midget electric-type train was one of first built for O-gauge track, of 1¼-in. width, which was introduced in this year and has become the most popular gauge today.



1937 New high in accuracy was this copy of Hudson-type locomotive of the Twentieth Century Limited, a stock model precisely built to scale of one-quarter inch to the foot.

Ingenious feats of remote control are highlights of half a century of progress as miniature railroading marks its Golden Jubilee.

for Electric Trains

By Alden P. Armagnac

PS PHOTOS BY W. W. MORRIS

SKILLED artisans of the Lionel Corporation, largest and oldest maker of toy electric trains, have turned out a miniature engine surpassing any night-before-Christmas dream.

It's a golden locomotive—a gleaming replica in precious metal, valued in hundreds of dollars, of Lionel's stock-model Santa Fe streamliner. Illustrated on this month's PS cover, it marks the Golden Jubilee of miniature railroading. It was a gift from the staff to the founder of the company, Joshua Lionel Cowen, who built the first toy electric train just 50 years ago.

You can't buy a golden locomotive, the writer was especially asked to add, lest anyone try—for there are model railroaders to whom expense is no object! What they *can* choose from though, should satisfy the most exacting 1950 fan.

Sleek streamliners whiz along a miniature right-of-way in a Lionel showroom, past automatic semaphores, winking block signals, and remote-control switches. Steam-type models belch smoke, and their whistles sound like the throaty wail of a big "hog" for a crossing at grade. Engines reverse and back up, take cars from sidings, and make up a train, all at the touch of distant buttons. And, this year, there's a new refinement called Magne-Traction. Magnetized driving wheels enable all of Lionel's 1950 locomotives to climb stiff grades, and on level track to pull extra-long strings of cars.

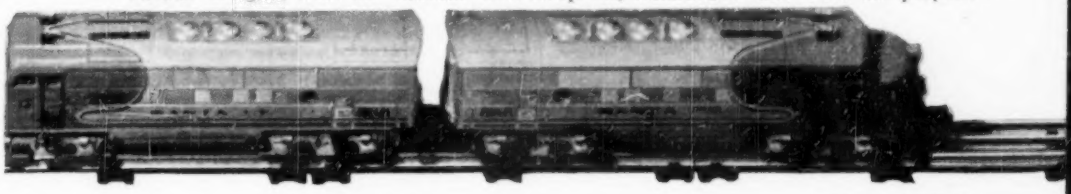
Like many a major railway system, this one grew from modest beginnings. Its story is one of a series of inventions as ingenious, and patentable, as any in large-scale railroading. Probably the most fascinating thing about toy electric trains is their ability to do lifelike things without the touch of a human hand. And ways of making them perform tricks by remote control account for a good part of Lionel's 170 patents.

Today a really rabid model-railway enthusiast would sooner grasp something violently radioactive than lay hands on a car to be moved or coupled. But even as simple a feat as starting and stopping a toy train with a distant control lever seemed like magic a half century ago.

Midget Motor Led to First Train

The year was 1900, trolley cars were still new-fangled, and railroads had just begun experimenting with electric locomotives, when Cowen built the first toy electric train. A young man of 20, he had perfected a miniature motor, which was being made for battery-powered electric fans by his newly founded Lionel Company. Seeking more uses

1950 Santa Fe streamliner is one of today's Diesel types. Miniature engines and cars are designed from the railroads' own blueprints, furnished to Lionel for this purpose.



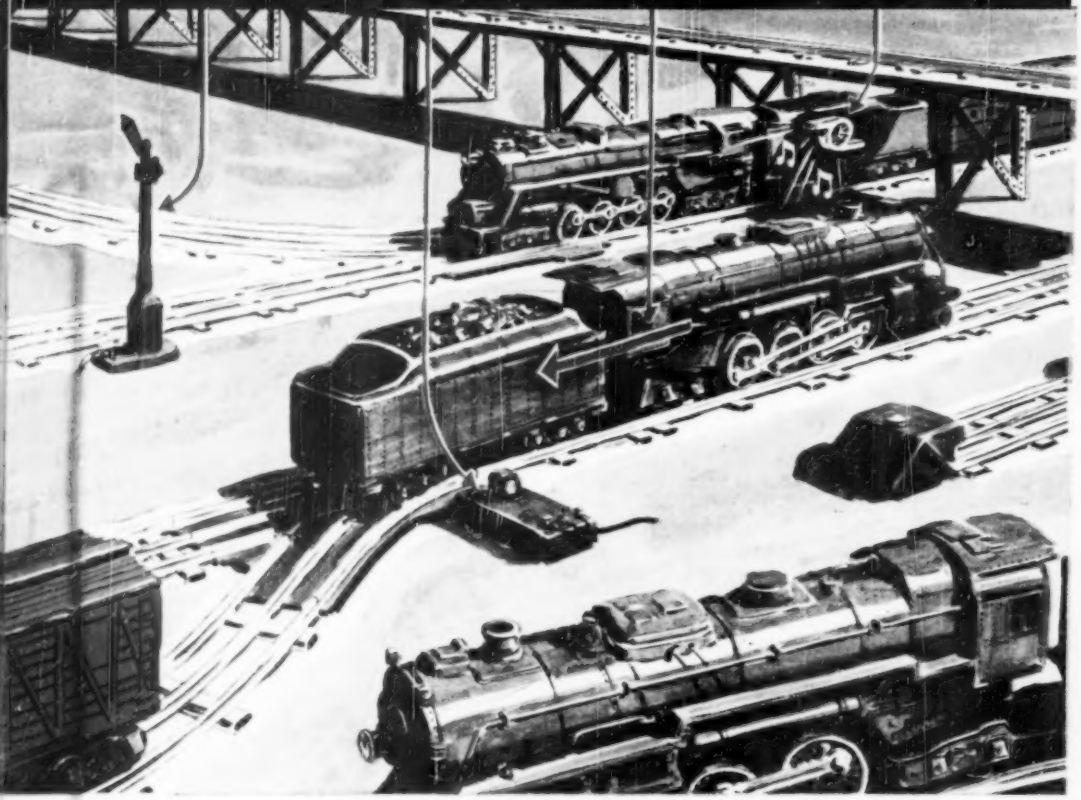
A Panorama of Progress in Miniature Railroading Reviews

First automatic accessory, electric semaphore, dates from 1921. It rises to "clear," then drops to "danger," as train goes by.

Remote-control switches, introduced in 1926, enable operator to set distant switch by flicking an electric-control lever.

Locomotives that reverse by remote control have enhanced realism since 1926. So has automatic mechanical coupling.

Whistle, added to tender in 1935, works by remote control. Realistic multi-tone sound seems to come from engine itself.



and customers for his motor, he hit on the idea of electrifying toy trains, of which the most elaborate were then windup clockwork affairs.

His 1900 electric train consisted of a power car with his motor beneath, and a trailer car. Through its wheels it drew current from two-rail track, to which batteries were connected. The tracks were metal ribbons set in wooden crossties. Wheels at opposite ends of a car axle were insulated from each other, preventing a short-circuit.

Three-rail track came in 1909. Its central third rail conveyed current to the train, and outer rails were connected to form a single return path or ground. This dispensed with insulating the car wheels. It also permitted more variety in track layouts. Track could curve back upon itself, and join to form a Y, without bringing the wrong outer rails into electrical contact. First three-rail track was of wide 2¾-inch "standard" gauge; in 1915 Lionel added the now-familiar 1¾-inch "O" gauge. Toy transformers had meanwhile replaced dry batteries to supply safe low-voltage power.

Miniature railways were now blossoming out with glamorously painted accessories that worked—hand-operated or mechanically tripped signals, crossing gates with ringing bells. In 1921 the first automatic electric accessory, a semaphore, set a new style. Weight of an approaching train closed an electric switch beneath the track

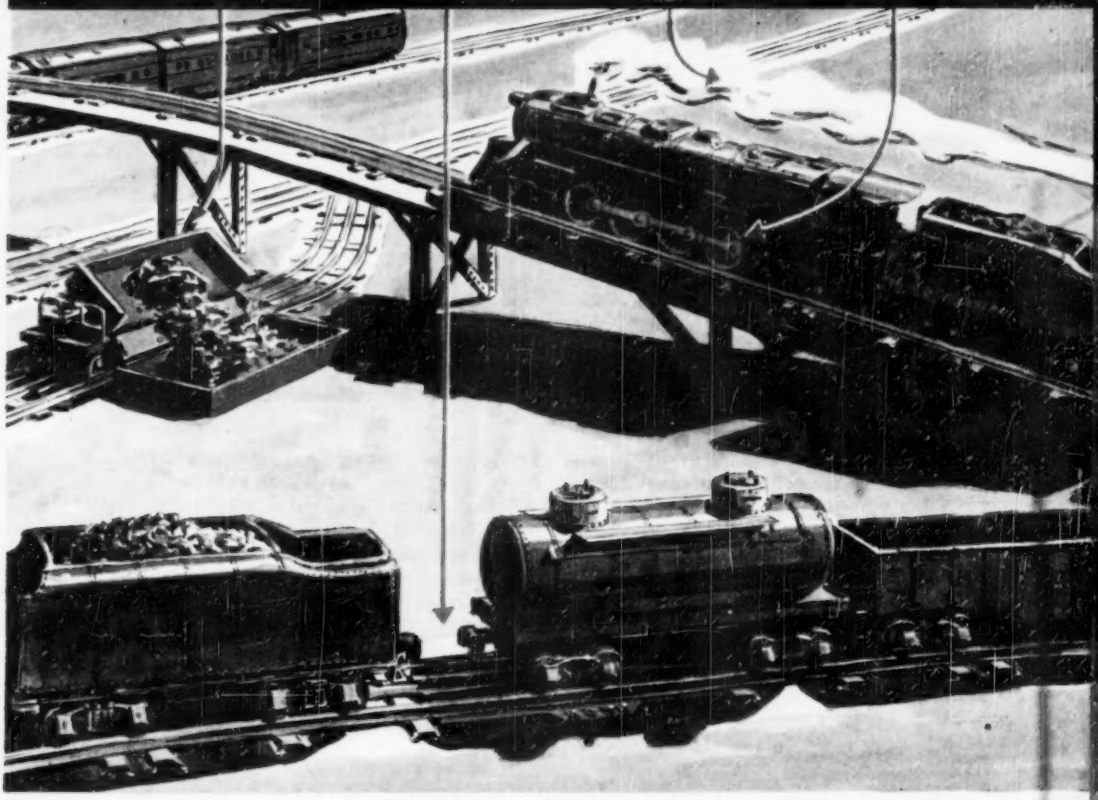
Some of the Most Ingenious of Lionel Innovations To Date

First electric "operating" car, a dump car introduced in 1938, tips and unloads coal when a remote-control button is pressed.

Uncoupling by remote control, another 1938 invention, employs same control-track section used to work "operating" cars.

Smoke, a 1946 refinement for locomotives, is produced by electrically heated chemical pellets. Piston "puffs" it from stack.

Magnetic traction, latest advance, enables all 1950 Lionel engines to climb stiff grades, or pull more cars on level track.



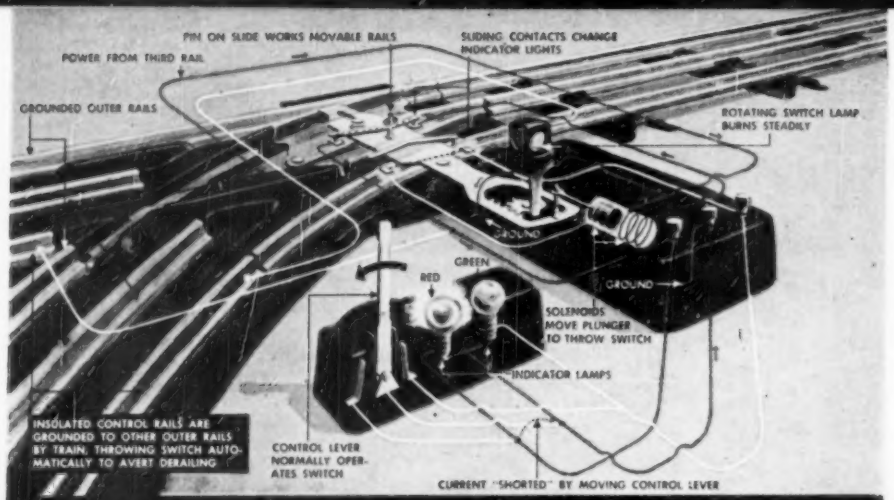
and worked the signal electrically. Crossing gates and an "automatic gateman" now work the same way.

First big step forward in remote control came in 1926. Lionel had already brought out a track-attached tripping device to reverse a train. Now it introduced locomotives that reversed electrically anywhere on the track. The trick is done by a built-in sequence switch with four successive positions —forward, stop, reverse, stop. Interrupt the track current by pressing a control button, and the rotary switch advances one step. Pressing the button the right number of times thus evokes any desired response from the train.

Remote-control switches, set by flicking a distant control lever, were another 1926 innovation. An ingenious anti-derailing feature, automatically throwing any wrongly set switch to avert a wreck, was added to the remote-control switches in 1931.

A sound recording of a New York Central locomotive's whistle helped Lionel match it with a toy one, perfected in 1935. Installed in a miniature train's tender, it consists of a midget electric blower and a pair of flutelike pipes, whose tones merge into the whistle sound. A remote-control button sounds the whistle. How it works may well mystify the user, for the instruction book doesn't tell.

The secret is a little selenium-disk rectifier within the whistle controller. It feeds



How remote-control switch works is shown by pictorial wiring diagram. Flicking control lever, in direction indicated, throws switch from curved position above to straight one. Switch also turns of own accord for train from upper left. Wires in color are now carrying current; those in white are not. On way to red indicator lamp, now lit, current flows through solenoid but is too feeble to work plunger. "Shorting" it past lamp to ground boosts flow, operating plunger and switch. Indicator lights change.

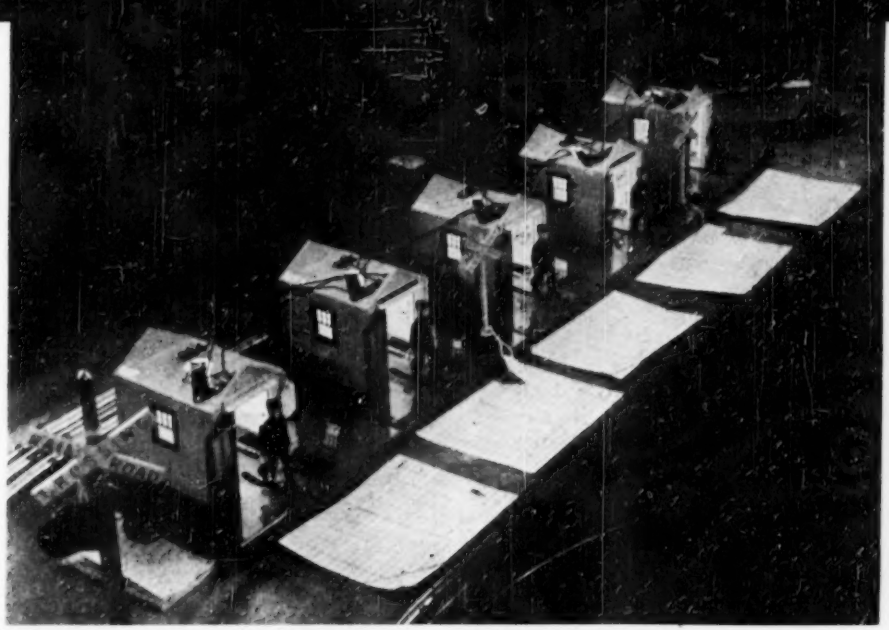
direct current into the track, *in addition* to the alternating current that drives the train, when the whistle button is pressed. In the train's tender, this actuates a relay that responds to direct current only, and closes a circuit that blows the whistle.

Finding still other avenues of remote control was a problem when, in 1938, Lionel introduced self-unloading cars and automatic uncoupling. An acceptable compromise was to confine these operations to sections of special remote-control track with extra rails. Pressing buttons made the auxiliary rails "live," and contactors beneath the cars drew current for their solenoid-operated mechanism. Newer mechanical couplers, replacing electrical ones, are magnetically operated by a coil in the special track.

Wired-radio operation of trains, a 1946 Lionel innovation, remains today the ultimate in remote control. Ten control but-

Magnetized locomotive truck clings even to upside-down track. Demonstration shows power of magnets used to improve traction by keeping engine's driving wheels from slipping.

Bars of magnet metal are inserted in miniature locomotive, which comes to worker on moving belt of assembly line in Lionel factory. At this stage, toy engine is nearing completion.

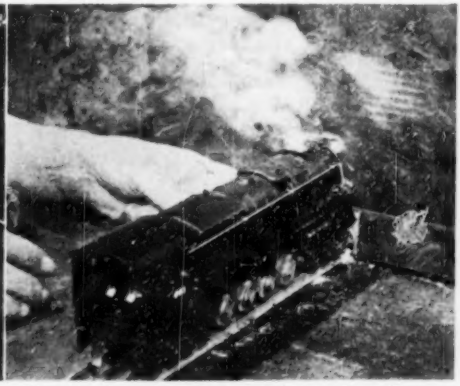


Endurance test is given five "automatic gatemen" by train circling track at Lionel plant. Device has figure that emerges, waving lantern to warn motorists, as train nears crossing.

tons, on a one-tube transmitter, send radio signals of different frequency along the track. On the train, selectively tuned receivers reverse the engine, blow the whistle, and unload and uncouple cars anywhere. Moreover, the system will independently control two or more trains on the same track. Not surprisingly, such a train set is the most expensive in the catalog.

A resourceful model railroader, however, can make less costly equipment perform marvels. Block signals and insulated track lengths enable two trains to run on one track without colliding. Interconnected switches automatically vary the route a train selects, as if worked by an unseen tower man. Look at Lionel's instructions for stunts like these, and it may seem as if you'd need to be an Edison to connect up the wiring of a modern toy railroad. But don't be surprised if you come upon little Junior doing it successfully! END

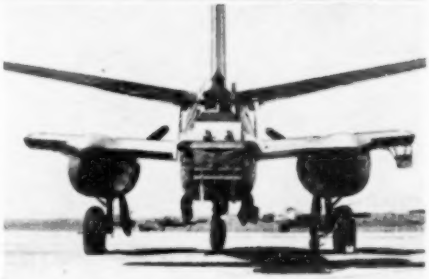
To magnetize inserts, worker places locomotive on pole pieces of electromagnet, which is energized for preset time by pressing button. Then engine goes back on assembly-line conveyer belt.



Finished engine gets running and smoke test on short length of track at end of the assembly line. Passing this final checkup gives it the "highball" to carton awaiting it.

"Wingless Wonder" Tests Landing Gear

THE warbird above has had its wings clipped, but performs an important service to America's fighting forces. The "Wingless Wonder," a salvaged B-26, is used by engineers at Wright-Patterson Air Force Base for skidding tests to obtain data for the designing of better landing gear. Clipped wings (right) cut the heavy plane's lift as it hurtles down the runways at 150 m.p.h. to be braked to a full-skid stop.



Toy Building Units Snap Together

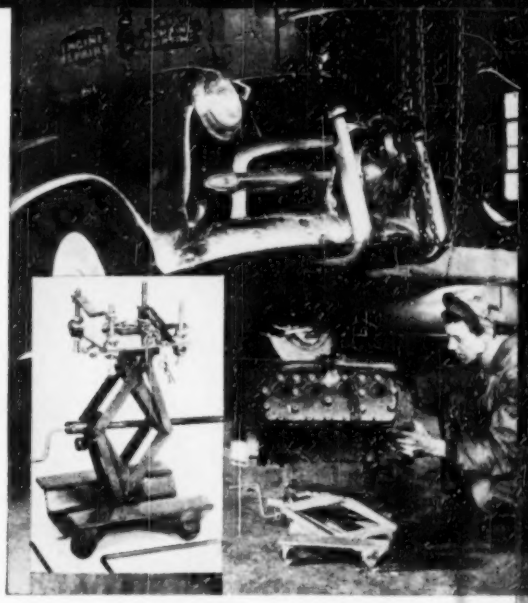
INVENTIVENESS and imagination are the only limitations to the variety of toys the youngster above can build with his set of colorful Tenite plastic units that snap together with rustproof fasteners. The geometrically-shaped pieces are said to be lightweight, chip-proof, sturdy enough to withstand rough play, and easily cleaned. Snap Blocks are made by International Molded Plastics, Ind., of Cleveland, Ohio.

Pointer Follows TV Action

A TELEVISION commentator or announcer can now insert a black or white pointer anywhere in a TV picture so that you can more easily follow the action he is describing. As shown above, the GE Electronic Pointer is mounted in a chassis containing a monitor screen. Control stick at lower right enables him to shift the pointer smoothly. The device should be especially helpful to televiewers during sportscasts.

Steel Frame Converts Truck to Bus

An ordinary light pickup truck can be converted to a small bus in a few minutes with this one-piece tubular steel frame, which slides into the truck body. Light enough to be handled easily by one man the Dixie Tallyho has three full-width padded seats. A heavy canvas top and side curtains give protection in bad weather. Alone, it is a beach cabana or lawn seat. Made by Dixie Tallyho, Inc., Fairburn, Ga.



Jack and Dolly Unit Moves Heavy Parts

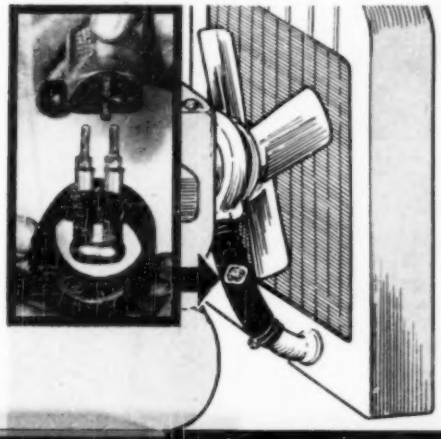
The problem of both lifting and moving heavy auto parts is solved by this dual-purpose unit called the Pak-Jak, made by the Tow Bar Sales Co., of Chicago. The device consists of a screw-type scissors jack mounted on a dolly. It weighs 70 pounds and has various detachable adapter heads to suit engines, transmissions, and differentials. Above, it is carrying an engine into position. It can be used as a conventional jack.

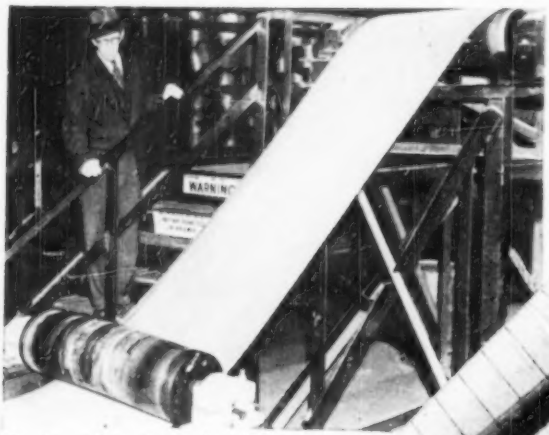
Heater Aids in Cold-Weather Starts

This electric immersion heater for auto engines, developed by GE, is inserted in a small hole cut into a lower radiator hose. It pre-warms the coolant surrounding the motor block. The inset shows the two parts that clamp against the hose to make a permanent watertight joint. Plugged to an electric outlet for a few minutes on cold mornings, the Calrod unit reduces engine wear and cuts drag on the battery.

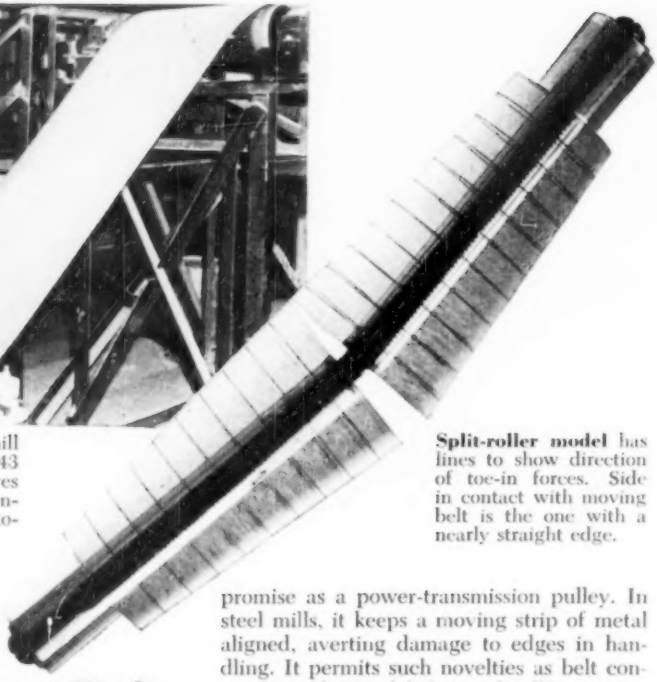
Steel Mat Helps Snowbound Cars

The flexible steel mat being placed under a car wheel below will help a driver out of ice and snow. Points of the wire rods holding the 16-gauge strips together project downward to give needed traction. One or more mats can also be used as a door shoe scraper and are easily cleaned by shaking them. Weighing 3½ pounds each, they roll into a small size for storing. William F. Klemp Co., Chicago makes the Handimats.





Toe-in roller in steel mill guides strip of metal 43 inches wide. Roller's halves may spin freely on stationary bent axle, or turn together with flexing shaft.



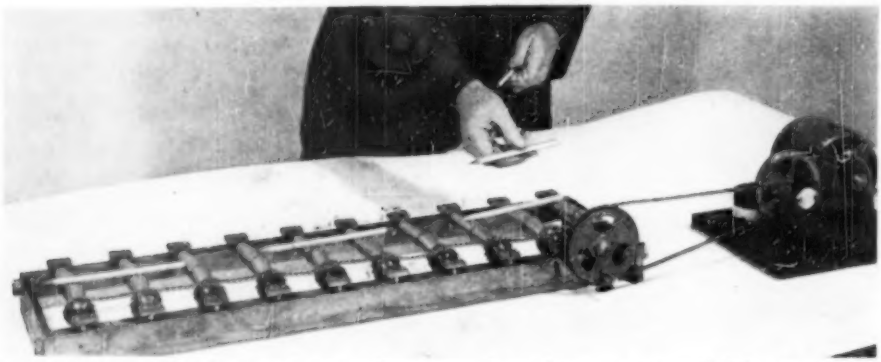
Split-roller model has lines to show direction of toe-in forces. Side in contact with moving belt is the one with a nearly straight edge.

Roller Makes Belt Toe the Line

BELTS and strips of metal go straight when they pass over a new "toe-in" roller. Although it presents a flat working surface, the roller exerts a lateral force that centers anything in contact with it.

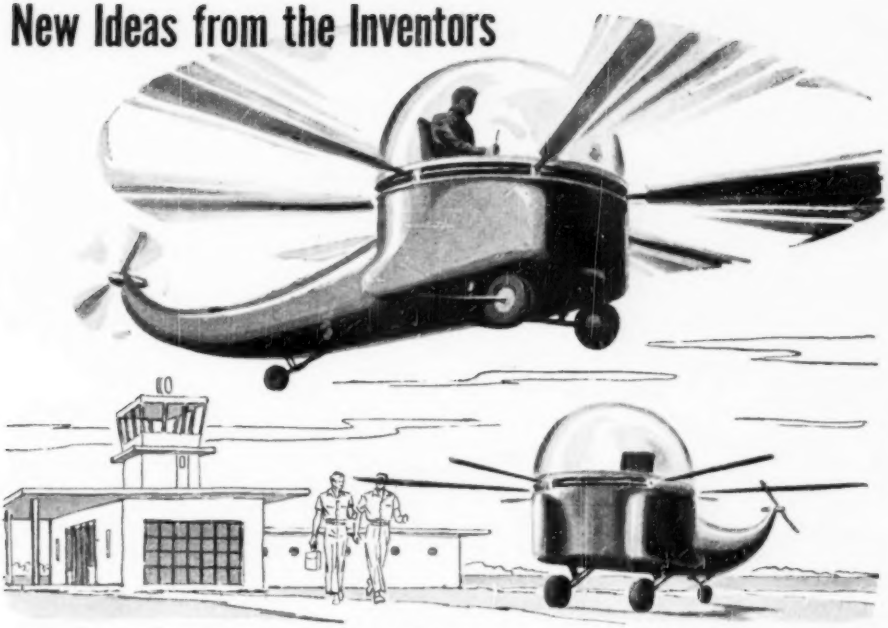
Since a belt won't slip off it, the roller has promise as a power-transmission pulley. In steel mills, it keeps a moving strip of metal aligned, averting damage to edges in handling. It permits such novelties as belt conveyers with metal belts, and roller conveyers that line up loose articles moving along a production line.

Invented by E. T. Lorig, U. S. Steel engineer, the roller is made of twin cones with axes askew, giving an almost straight working side. The cones' lateral friction shifts an off-center belt sideward—toward the center, then away, at each passage. Since the first effect is greater than the second, a net centering action results.

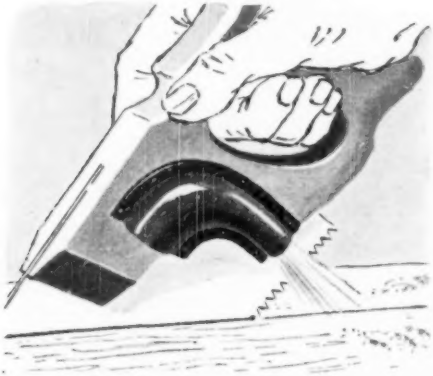


Dropped askew and off-center on twin rollers, pencils are automatically straightened and centered as they move toward left, in working model of roller conveyer using new principle.

New Ideas from the Inventors



1 'Copter to Clear Pilot's View. Instead of windmilling above the fuselage, the blades of this helicopter would rotate around the cockpit. Besides providing better visibility and easier escape in case of an emergency, it is claimed that this position of the blades, being nearer the aircraft's center of gravity, provides improved stability and control and allows more blades to be used to provide greater lift.

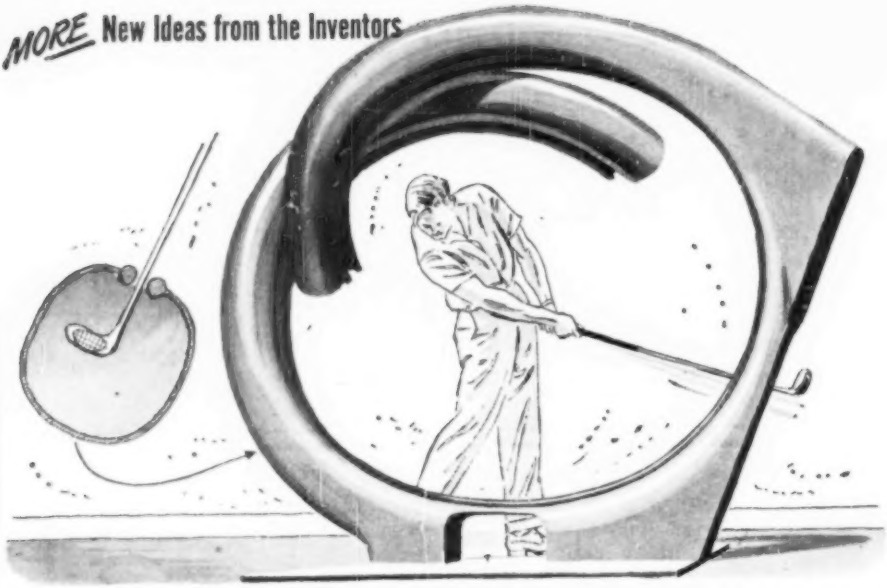


2 Blower to Remove Sawdust. Acting like an air scoop, this device attached to the side of a handsaw handle blows away the sawdust that drops on the saw line during the backward stroke. Air entering the scoop on the forward stroke of the saw is directed, through a tapering, curved passage, downward toward the wood.

3 Christmas Star to Douse Fire. Designed for the top of a Christmas tree, this star filled with fire-extinguishing fluid serves as a safeguard as well as an ornament. A spring trigger, normally held in a cocked position by a fusible element, is released if the tree catches on fire. This breaks the star, spraying the tree with the liquid chemical.

Turn the page, please, for three more new ideas.

MORE New Ideas from the Inventors

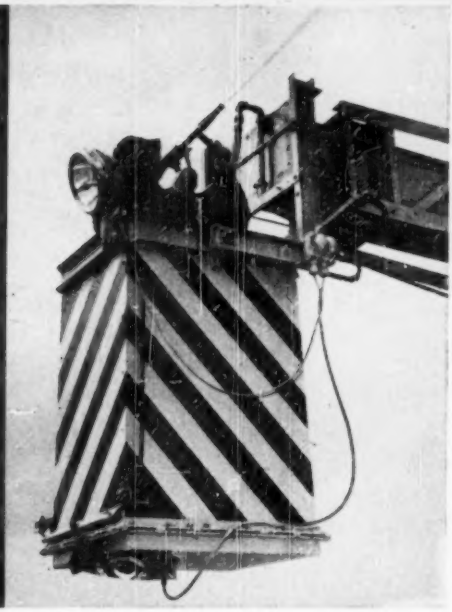


4 Swing Guide to Train Golfers. A golfer using this training device can't do anything else but execute a perfect full swing. The head of the club, riding in a longitudinal slot, is guided throughout the entire swing. A chart or mat on which the golfer stands shows the correct foot positions that should be used with each of the various types of golf clubs. Balls are placed on the tee and can be actually hit.

5 Vacuum Cleaner to Burn Dirt. Dust and dirt sucked into the tank of this portable vacuum cleaner would be passed over a helically shaped white-hot electric element and burned to ash. The ash drops down into a collecting receptacle and the air is passed through a charcoal filter to remove all odors before being exhausted.

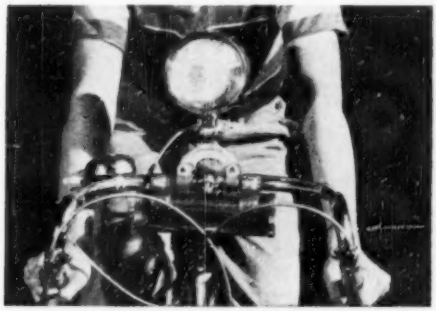
6 Snow Scoop to Save Stooping. A second handle, consisting of a wire loop fitted with a grip and attached to a snow scoop with a cotter pin, makes it easy to shovel snow without back-bending. The wire, free to slide through the eye of the cotter pin, allows the shovel to be maneuvered or turned as desired.

Patents on these inventions have been granted to: 1. M. Bates, Brooklyn; 2. J. Laudien, Gary, Ind.; 3. H. Leon, Brooklyn; 4. J. Plunkett and E. Doron, Niagara Falls, N. Y.; 5. L. Devo, Lewiston, Idaho; 6. E. Buckley, Bala-Cynwyd, Pa.



Power-Line Insulators Cleaned by High-Pressure Water Jets

THE man in the crow's nest above is busy giving the insulators of Southern California Edison Company's high lines their regular washing behind the ears. Dressed in oil-skins, a lineman blasts dirt away with high-pressure jets from a 700-gallon tanker. Dirty insulators may break down electrically under voltage surges.



Bike Gets Block-Long Light Beam

THIS new Westinghouse bicycle lamp throws a beam of 5,000 candlepower. Patterned after sealed-beam automobile headlight, it operates on either three or six flashlight batteries. Lamp costs $1.75; mounting brackets and battery case are extra.

Altitude Affects Eyesight

ONE FIFTH of the people living in a town more than 15,000 ft. above sea level in the Andes have been found to have only two-thirds normal vision. Dr. Jorge Valdeavellano, of Lima, Peru, reporting to the Third Pan-American Congress of Ophthalmology, laid the blame for this deficiency on enlargement of blood vessels.

Rockets Release Anti-Red Leaflets

THE tub-like object above is the latest weapon in the Cold War—a propaganda rocket. A young German is about to fire it over the border into the Soviet sector of Berlin. A double explosive charge first sends it flying hundreds of feet in the air, and then blasts it apart to rain anti-communist leaflets upon Red territory. A thousand leaflets can be packed into the six-inch diameter of the two-foot tube.

You get a funny feeling when you climb into the '51 Ford and can't find a clutch pedal.

REPORT FROM THE DRIVER'S SEAT . . .

Shaw Drives the New

Trying out this long-heralded automatic drive, a gear-assisted torque converter, Shaw says it's the best on the road.

By Wilbur Shaw

EDITOR'S NOTE: This month POPULAR SCIENCE'*s automobile reporter sneaks you through the guarded gates of the Ford proving ground for a preview of the newest automatic drive.*

BACK in 1948 the Ford people bobtailed their engine—they began casting the bell housing separately from the block. It was a tip-off they had other changes in mind.

They did. It's here now. Ford—and Mercury, too—for 1951 have those long-awaited automatic transmissions. Bobtailing the engine was just to get ready for a torque converter in place of a clutch.

They're optional, these new transmissions. You pay extra. Whether you'll be willing to depends on whether you react to this new transmission as I did.

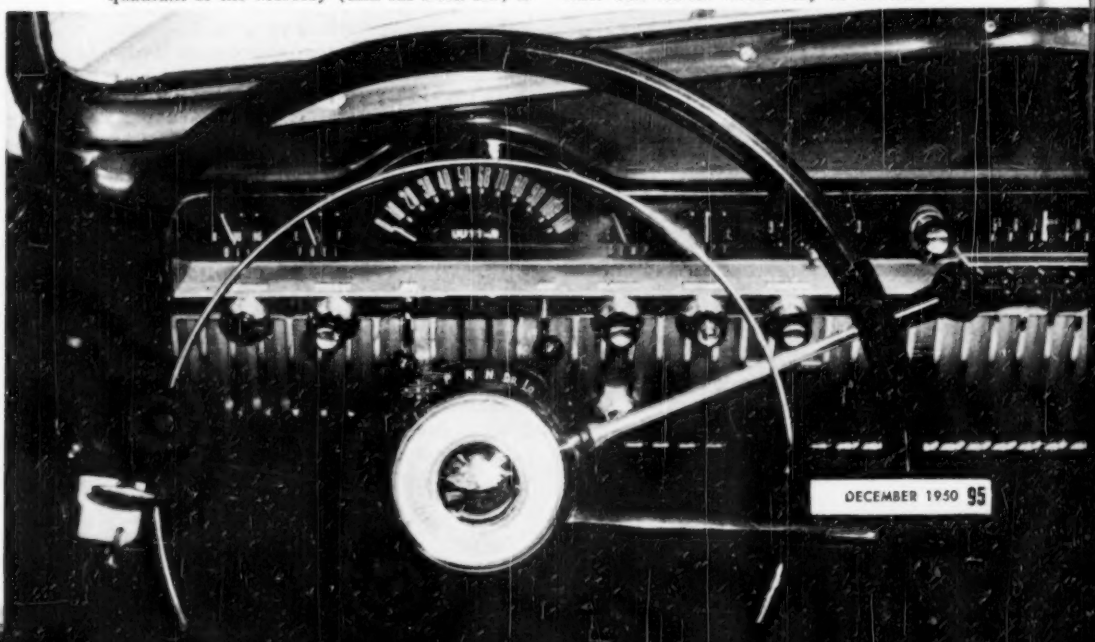
Now, I may as well admit that I'm prejudiced when it comes to these automatic drives. I got rid of one car largely because I didn't like its do-it-for-you transmission. It would shift when I didn't want it to, and wouldn't when it should. In preference to some of these newfangled drives, give me the old low-intermediate-high shift lever any day. They keep telling us that automatic transmissions simplify driving. I question this, at least under some conditions.

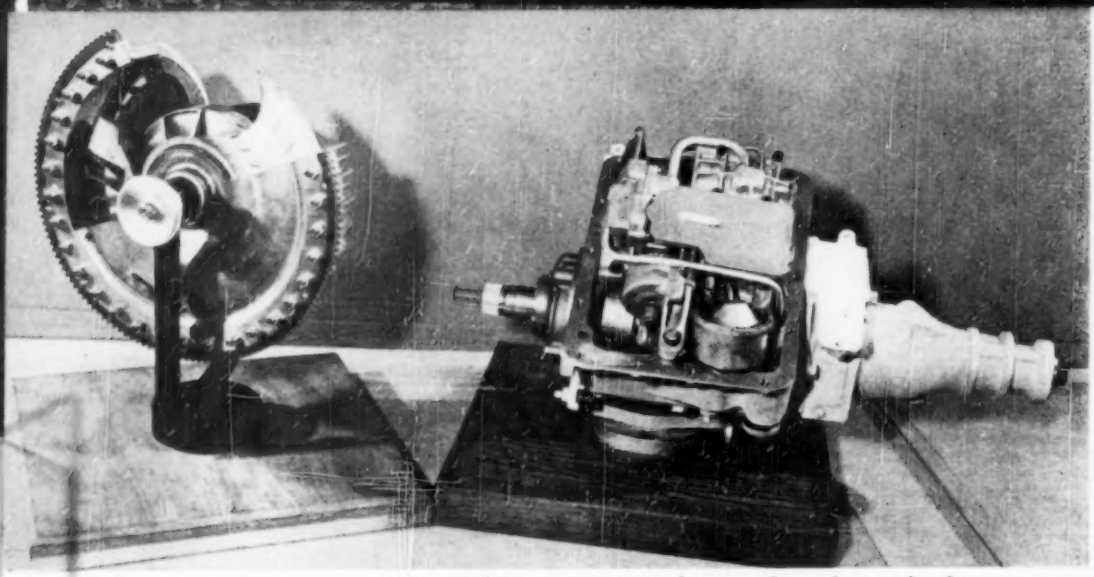
I was delighted when I was invited to Dearborn late last summer to try out the new Ford-Mercury drive. First off, I went to see my friend Harold Youngren, the company's vice-president of engineering. The

I rolled the new Ford-Mercury automatic transmission on the proving ground "fast track" in this '51 Mercury to see how it would act compared with the standard three-speed gearbox.

Ford-Mercury Transmisson

The arrangement of positions on the selector quadrant of the Mercury (and the Ford too) is different from that of other automatic-drive cars. The starter works only in neutral.





These are the working parts of the new drive. At the left is the torque converter, cut away; at the right, the gear box. The converter is air-cooled. Actual engine revolutions per mile average out between those of a regular drive and overdrive. The rear-axle ratio for both Ford and Mercury is 3.31:1—as against 3.73 and 3.79 respectively with a regular transmission.

new transmission is Harold's baby. He started working on it at Borg Warner years ago and his labors have now borne fruit. He explained how it worked, and it was obvious he is proud of it.

The Ford-Mercury drive is sort of halfway between Packard and Studebaker on one hand and Buick and Chevrolet on the other. Like Packard and Studebaker, the Ford-Mercury transmission has a torque converter that is *gear-assisted* some of the time when the selector lever is in the Driving Range position. This intermediate gear, used most of the time from a standing start, helps the torque converter get the car under way. But it slips out of the power train as the car gains speed. For more zip on a hill or in passing, you can kick the transmission down into intermediate at anything below 58 m.p.h. And like all these new torque-converter drives, the Ford-Mercury also uses gears for low and reverse.

Benson Ford, who heads the Lincoln-Mercury Division, is mighty proud of the new drive. He's on the right in this picture, taken when he paced the 500-mile race in a 1950 Mercury.

Torque Converter Not Locked Out

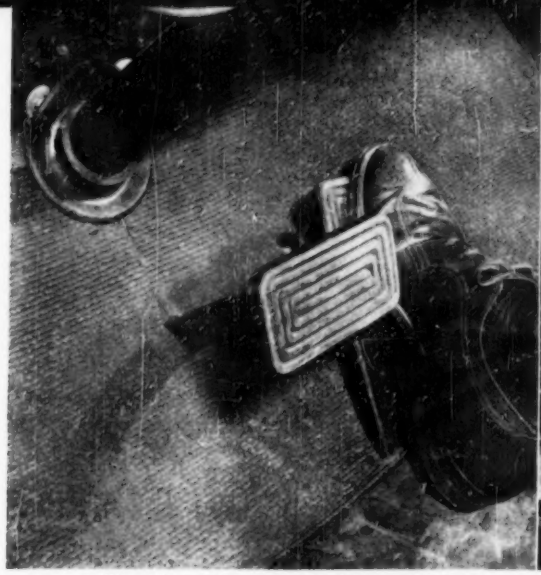
The Packard and Studebaker converters lock out of the power train at certain speeds. The important difference in the Ford-Mercury drive is that, whether the converter is acting to multiply torque or as a fluid coupling, it's always in the power train.

That makes it somewhat akin to Buick and Chevrolet. But there's a difference there too. Buick's Dynaflow and Chevrolet's Powerglide do not have a gear-assist for the converter in driving range [PS, April '50, p. 98].

It seems to me that Ford-Mercury has incorporated the most desirable features of all the automatic transmissions I know about. It's a smooth, well-engineered job.

From Harold's office I went to the track. This is on the old Ford airport, which has been converted entirely to proving grounds. Most of the track is fairly flat, but one of the curves is banked for 90 m.p.h.

My first mount was a Ford Six with the new transmission. I was glad that a six was available. It would be new to me. I climbed into the left-hand seat and turned on the re-



The first picture with this article shows my *left* foot on the brake pedal. Here's a close-up of the extra-long pedal. A lot of drivers will use that left foot, especially in parking.

Here's the underside of the drive. The left arrow points to the air intake for cooling the converter. The right one points to the air outlet. The transmission holds 9 quarts of oil.

cording machine I use to wax my impressions during a drive. Here are my comments:

You can start the engine, with this new transmission, in only one position of the selector lever. That's in neutral. That's okay . . . a good safety provision. You could get yourself into trouble otherwise.

I like the arrangement on the selector quadrant. It's different from the rest. Neutral's in the center. Reverse is to the left of that. It'll be easier for the average motorist to get used to the position of the lever in reverse. It matches the position of a conventional lever.

This shift is hard. It's a good deal harder than in a regular transmission. Maybe it's just this car, and the production jobs will be different.

With the selector lever at drive, I eased down on the accelerator and began rolling along a broad strip of concrete.

Well, you can't deny it . . . this transmission is smooth. With light accelerator pressure, you can go out of intermediate into "high" at about 17 miles an hour . . . but you can stay in intermediate . . . you can keep it from shifting . . . clear up to almost 60. Just tromp on it, that does it.

I kept starting and stopping, feeling out the acceleration and trying my best to detect the point where the intermediate gear let go.

I can get the transition now . . . I can feel it going . . . from intermediate into high . . . but you can just barely feel it. It's that smooth.

I honestly believe this is the smoothest acceleration I have ever experienced from zero to cruising speed. Now we're coasting. Foot off the accelerator. We're slowing down. There! She slips into intermediate at about 5 m.p.h. And I mean slip. Hardly perceptible.

Kicking It Down Isn't Necessary

I wheeled onto the fast track. By this time I was beginning to like the fast acceleration qualities of the converter-plus-gear. I also was beginning to understand what Harold Youngren meant when he said that keeping the converter in the power train gave this transmission a lot more flexibility. You didn't necessarily have to hit the accelerator hard, striking a button underneath on the floor, as you do to get out of overdrive, to get a burst of speed. The instant you open the throttle, the converter begins giving you more push. Yet you can throw the gear part of the transmission back into intermediate for even more torque by depressing to the button if you want to.

You get performance, all right, but I wonder what it costs in gasoline. It must be plenty.

I was wrong. The word I get is that gas

Harold Youngren told me, "I'm perfectly satisfied that a lot of people are going to drive this transmission for the entire life of their cars without once shifting into low range."

mileage averages better than with a standard gearbox, but not quite as good as with overdrive.

We're doing 55. Now I'm going to pull the selector lever into Low Range. Such procedure can create havoc with some transmissions. This one reacts beautifully. Just normal fast deceleration . . . That's good.

The gimmick is that shifting into Low Range at that speed puts you, not into low, but intermediate.

Low-Range Protection Is Automatic

Now I'm getting it. At about 30 miles an hour, as you decelerate, the shift into Low Range does occur. If the shift from high to low at speed wasn't delayed by the automatic intervention of intermediate gear, it would pitch you into the windshield . . . what a beautiful piece of engineering!

You need Low Range . . . there are times when you need extra braking power in going down hills, or more oomph in going up. Still, you'll rarely use it.

Engine braking effect is on the debit side. The braking effect, compared with that from a conventional transmission, leaves something to be desired. But that is characteristic of all these new torque converters. And it is not a serious factor.

I wanted to try out the transmission in sand, and I left the track to drive to the Ford heavy-going course. When the car was thoroughly bogged down, I tried rocking it.

This isn't so good. You have to cross through Neutral to shift back and forth between Drive and Reverse. That takes some doing. I'll have to revise my estimate of the positions on the quadrant. This car is hard to rock. You might have your troubles . . . getting out of snow, sand, or mud. But you're supposed to stay out of that kind of trouble.

In a 1950 Mercury body on a 1951 chassis, I left the proving ground to do a little driving in traffic. In hard stop-and-go driving through Dearborn the transmission proved to be everything the Ford people claimed for it. It would scat like a cat when you hit the accelerator.

A Little Creep

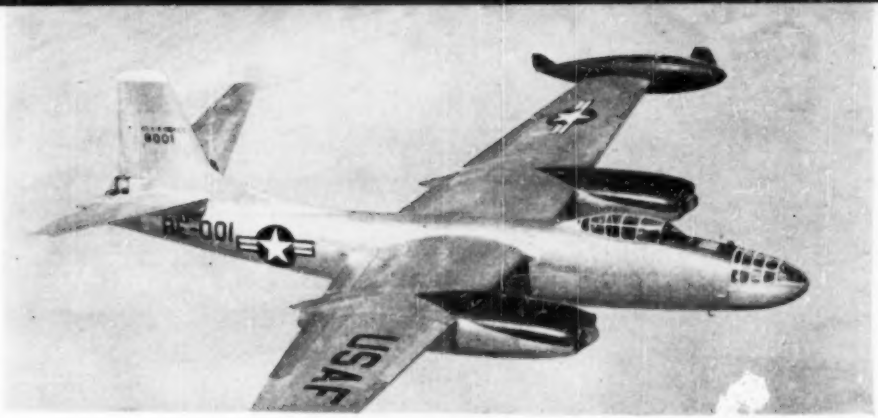
This engine idled a little fast and the car had a tendency to creep. I had to keep my foot on the brake pedal at a stoplight. But with practically any of these new transmissions, you can't have all this and Heaven too. Give Studebaker credit. They've whipped that creep problem.

But creep or not, I'm going to stick my neck out on this new Ford-Mercury transmission. And get into a peck of trouble with partisans of the other automatic drives. Nonetheless, it's my considered judgment that the Ford-Mercury drive is the best of the lot. It paces the field. END

They're steel workers. A monkey is steel workers' lingo for a tap hole for drawing off slag from a blast furnace.

This Month's Shaw-ism

The driver who is as courteous in his car as he is in the boss's office hardly ever gets into an accident.



Wing Tanks Increase Bomber's Range

FUEL tanks mounted on the wing tips of this North American B-45C jet bomber give the plane a longer reach, increasing its former 800-mile radius. The nacelles of the engines and the tanks are painted black to reduce glare in the pilots' eyes. The bomber can carry more than 10 tons of bombs at a speed of 550 m.p.h.

Milk Cooler Is Easier to Load

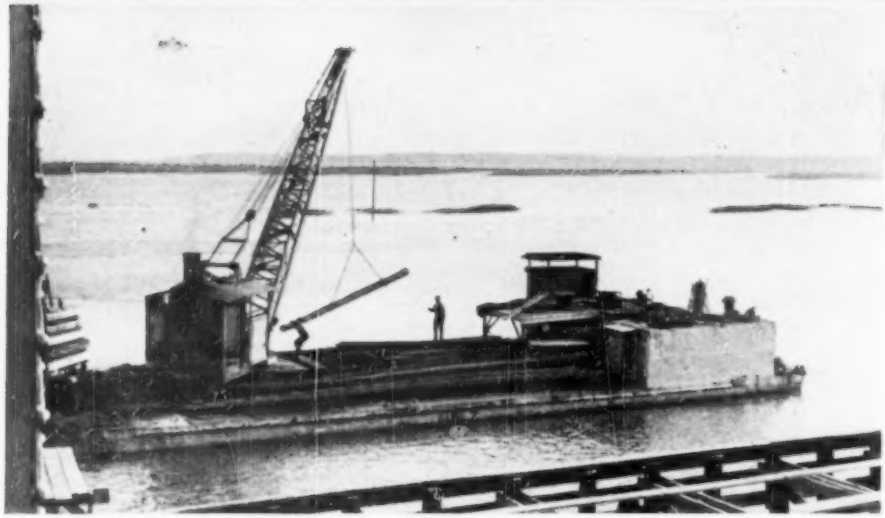
A NEW kind of milk cooler is taking some of the load off farmers' backs. It opens from the front so that 110-lb. milk cans need be lifted only 11 inches. With old-style, top-opening coolers, the cans must be raised three feet to be dunked in cold water. The Westinghouse cooler sprays 25 gallons of water a minute over the cans, chilling milk from 90° to 45° in 1½ hours.

Flying Lab Coats Itself with Ice

THE jungle of pipes attached to the side of this C-54 flying laboratory helps engineers at Willow Run Airport to test aircraft de-icing equipment aloft. Nozzles on the pipes spray ordinary water, in the form of rain, snow, or fog, on the plane. In freezing altitudes the spray becomes a coat of ice. Despite its size, "Squirtin' Gertie" doesn't produce much drag on the plane.

Light Is Strong Enough to Read By a Mile Away

EVEN a mile away, the light from this new portable searchlight is so bright you can read a newspaper by it. Fitted with a 200-watt, sealed-beam lamp, it plugs into an ordinary 110-volt socket. The searchlight has an adjustable stand, and is useful to farmers, mechanics, and others both for area illumination and making night repairs. Unity Manufacturing Co., of Chicago, also make other models that use 6-, 12-, or 32-volt power and have plugs for automobile or marine use.

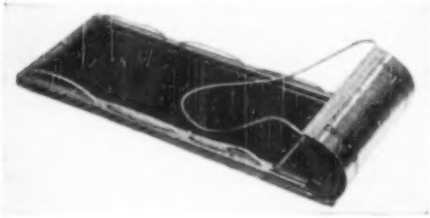


Converted LCT Repairs Highway Bridges

THE converted Navy LCT (Landing Craft, Tank) above is busy cutting bridge maintenance costs for the South Carolina Highway Department. Stripped of its superstructure except for two deck houses, the vessel was rebuilt with a level deck. Timbers and pilings are handled by an old 20-ton steam locomotive crane mounted at the bow. The craft has three Diesel propulsion units and a Diesel-driven motor generator.

Taped Wool Tufts Test New Automobile's Contours

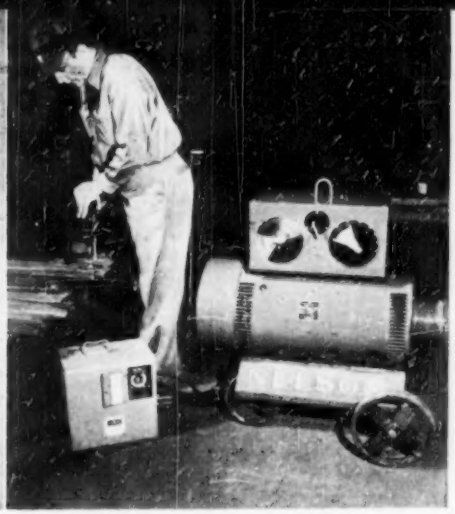
BEFORE incorporating final design changes in the new Type 401 automobile, engineers of the Bristol Aeroplane Co., of Britain, took a tip from their aircraft division and taped tufts of wool all over the body of an experimental model. Photographs taken as the car was driven through its speed range determined the direction of air flow over any point on the body and gave a visual check of aerodynamic efficiency. Results: cleaner bumpers, swept-under side panels, and repositioned lights.



Aluminum Toboggan Is Light, Tough

MADE of heavy-gauge aluminum, this new junior toboggan (left)—3½ feet long, 16 inches wide—weighs only 7 pounds. Flush rivets leave the bottom smooth for a fast ride over snow, sand, or grassy slopes, and the flexible bow doubles as a bumper. The Duraboggan is made by Duratech Mfg. Corp., Tarrytown, N. Y., to sell for $10.95.

Casement windows are bolted to lintels by studs quickly welded in place. Power source in foreground is battery-operated, has its own charger.



Motor-generator, above, is used where power is available, delivers as much current as two conventional 400-amp. generators in parallel.

Ceiling fixtures will hang from these studs welded to channel-type flooring. Gun is also handy in replacing broken or sheared bolts.

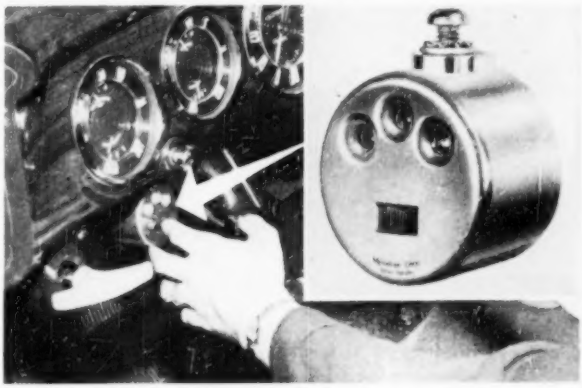
Stud-Welding Gun Speeds Building

THIS welding gun, holding a stud up to ⅝ inches in diameter, is pressed against a steel beam. When the trigger is pulled, the stud is quickly and strongly end-welded in place. Designed by a shipyard worker during the war, the Nelson stud-welding gun helps builders in mounting window frames and holding plumbing fixtures. In the new UN building in New York City, it's estimated that the use of welded studs to fasten the floor-to-ceiling windows eliminated drilling and tapping 50,000 holes in steel beams.

Dashboard Lights Reveal Car Battery Condition

A NEW device that is bolted to the dashboard instantly tells a driver the exact condition of his auto battery. With the unit on, the driver presses the starter button. If all three lights on the unit (inset) light up equally brightly, the battery is in good condition. If one or more lights are dim, it shows which battery cells need attention. Flickering lights mean low water level.

Detecto-Cell is sold for about $6 by the Myriatron Corp., of Pontiac, Mich.



Pyramided at right are just some of the 60-odd products, made in hundreds of varieties, that now come in squirt cans.

You Wouldn't Know The Old Bug Bomb

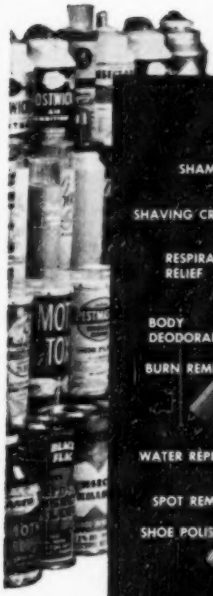
Modern pressure cans squirt everything from shaving soap to shoe polish, from paint to pancake batter.

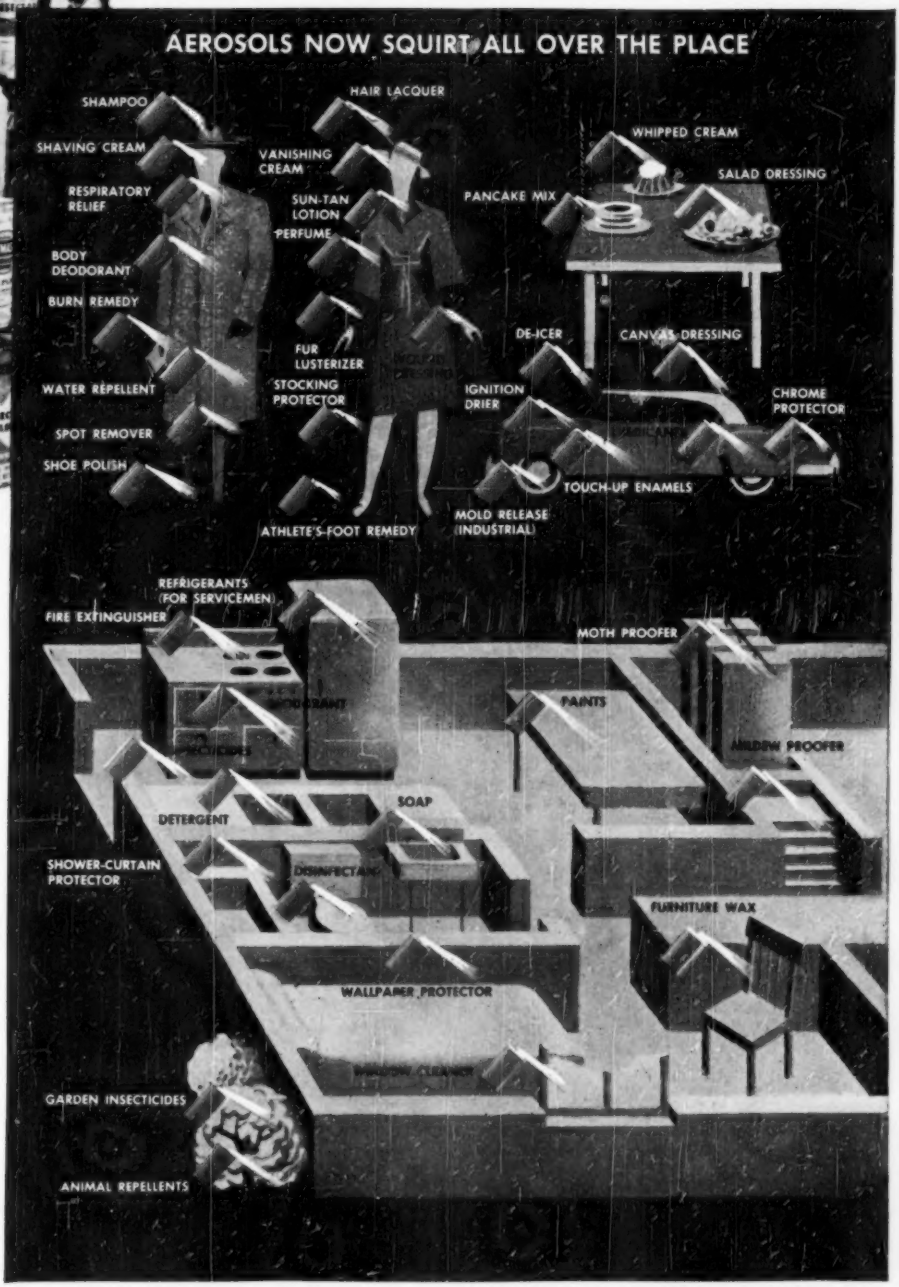
By Sheldon M. Gallager

DRAWING BY JERE DONOVAN

THE bombs that put the blitz on bugs for our GIs have gone to work at home. Called aerosols, these pressure-powered, push-button dispensers are being recruited to do an increasing variety of peacetime chores, saving time, work, and money. Fitted with tiny valves and pinpoint nozzles, they now spray out everything from perfume to shoe polish at the touch of a trigger. Other containers, fitted with slightly different valves, squirt out pre-foamed globs of shampoo, shaving soap, whipped cream—even pre-mixed pancake batter, ready to fry.

The original bomb was well named. A high-pressure, heavy-walled steel container, packed with gas at 70 pounds, it looked like a bomb, was heavy enough to be one, and cost from $3 to $4, with refills for about $2. Now you can get low-pressure, disposable dispensers, operating at 40 pounds or less, at half the cost. A 12-ounce can of DDT,





From attic to cellar, garden to garage, there is scarcely an area in the home, as the drawing above shows, that has not been invaded by the modernized bug bombs. Doctors, too, can now look forward to germ-killing wound dressings, surgical soaps, adhesive-tape removers—even local anesthetics. Also in the works are specialized sprays for industrial uses.

equivalent to 2½ gallons of spray-gun insecticide, costs as little as 98 cents.

The new low-pressure container, made of lightweight tinplate, is essentially a beefed-up beer can. In fact, the normal pressure in a beer can at room temperature, or 70° F., is actually greater than that in an aerosol container at the same temperature. Only at higher temperatures, above 130° F., do aerosols begin to outpush beer, requiring a stronger container. Continental has one with heavier walls than a beer can, concave top and bottom, and a special interlocking side seam. Crown Can, working on its own, has developed a one-piece, drawn dispenser that eliminates all seams but the bottom one.

The gas, put into the containers under refrigeration to keep it liquefied, serves a double purpose. Part of it remains in solution, dissolved in the liquid concentrate to be dispensed, while part of it vaporizes, filling the headspace between the concentrate and the top of the can. The gas above the concentrate serves as a propellant to force the liquid up a siphon tube and out through a fine jet. At this point, the gas still in solution takes over to finish the job. Expanding rapidly as it leaves the nozzle, it blasts the liquid concentrate into an ultrafine, mistlike spray.

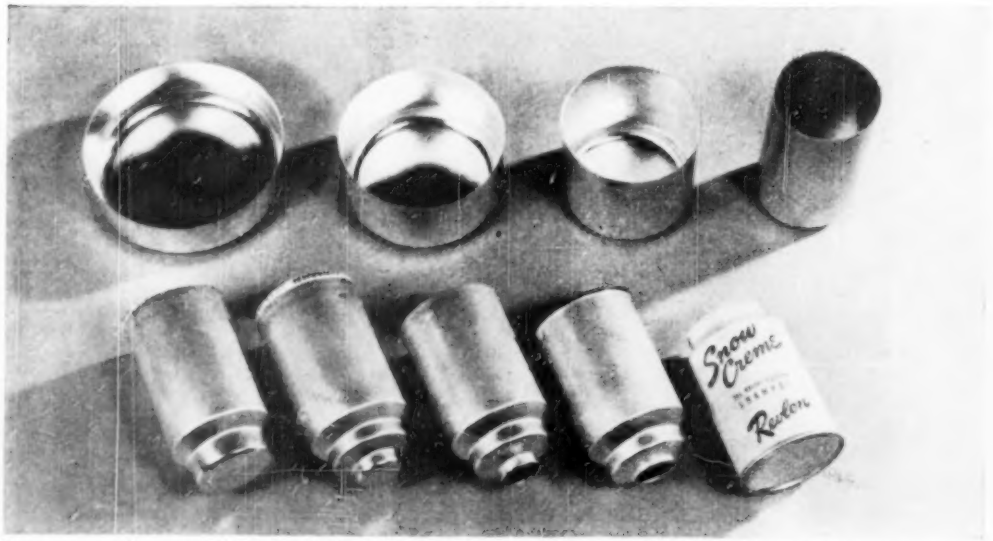
In the foam-type products, like shampoo and whipped cream, the principle is the same, but the effect is slightly different. The gas particles trapped in the concentrate expand as they leave the nozzle, whipping the liquid soap or cream into a fluffy lather. Large nozzles, instead of pinpoint jets, keep the foam from becoming a spray.

How Pressure Is Determined

The pressure inside an aerosol container is determined not by the *amount* of gas put in, but by its *vapor pressure*. This is a property of the gas itself and varies with each kind used. At any given temperature, it is the pressure at which the gas in the headspace of the can condenses back into liquid form just as fast as the liquid gas vaporizes. At this point, evaporation and condensation balance each other, and the pressure remains constant.

Each time you use the can, you let out some of the liquid, increasing the headspace and causing a slight drop in pressure. But as the pressure drops, it lets more of the liquid gas evaporate, filling the increased headspace and building the pressure back up again. Thus, the pressure always remains the same whether the can is full, half full, or down to the last drop.

Aerosols, though they have become the name for all pressure-propelled products, are



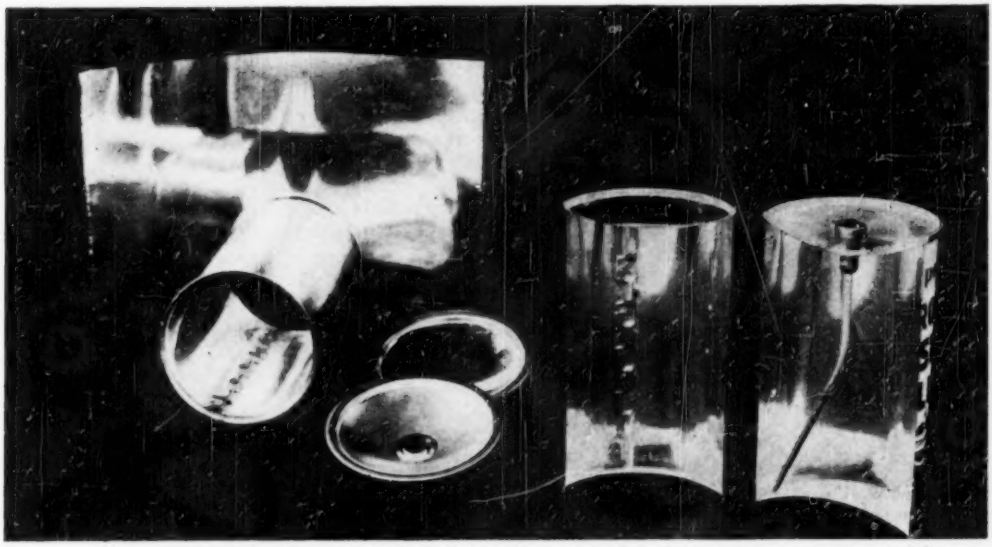
Strong, seamless container, made by Crown Can Co., starts out as shallow pan (top left), is drawn by successive stampings into tall, narrow can. Then neck is formed and top is cut out for valve (bottom row). Finally, concave bottom is attached and label is lithographed on.

True aerosols, like insecticides (left), produce fine mist that hangs in air. Surface coatings, like car wax (center), produce coarser, wetter sprays, are called surfasols. Foams, like whipped cream (right), have larger nozzles, higher pressure, are called aerated products.

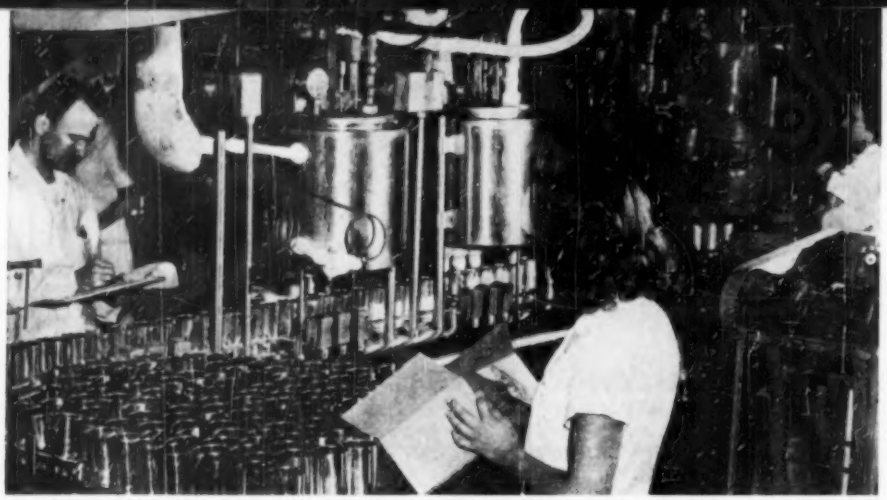
actually only one of three basic types. True aerosols, like insecticides and room deodorants, produce a fine mist designed to hang in the air a long time before settling. Paints, polishes, and similar coatings, intended to cover a surface rather than hang in the air, are produced by coarser, wetter sprays and are called surfasols. The foams, not sprays at all, are called aerated products.

To get exactly the right spray or foam, the pressure of the gas used must be carefully tailored to each type of product. A perfume spray, for example, must be coarse enough to form a film like a surfasol, yet nearly as fine as an aerosol to avoid drenching its user. Too little pressure, failing to break up the particles finely enough, could turn the desired mist into a shower bath. And because a perfume depends for its overall odor upon the order in which its various ingredients volatilize, too much pressure, changing that order of volatilization, could actually alter the perfume's scent.

In most cases, the thicker the liquid to be dispensed, the higher the pressure required. Filling techniques vary with each manufacturer, but a typical pressure for true aerosols, thin in consistency, is around 25 pounds. The thicker surfasols average 35 to 38 pounds, while the foams require at least



Beer-can-type dispenser, made by Continental Can, begins as flat sheet, is then bent into cylinder. Cutaway can shows siphon tube, angled to get last drop. Note concave top and bottom to withstand pressure. Special side seam interlocks like Indian grip, takes 300 lb. pressure.



At packaging plant, cans are filled under refrigeration to keep gas liquefied so it can't escape. Twin dispensing tanks, chilled to –30° F., squirt gas and concentrate into cans as they pass on conveyer at up to 60 a minute. Cans are quickly capped by machine in background, then tested for leaks at 130° F., where pressures hit up to 150 lb. per sq. in. Bostwick Laboratories plant above, in Bridgeport, Conn., alone turns out over 100,000 aerosols a day.

40 pounds and, in some cases, much more.

The original high-pressure bombs were charged with du Pont's Freon 12, an inert, non-inflammable, relatively non-toxic liquefied gas that vaporizes to produce a pressure of 70 pounds per square inch at 70° F. With the development of low-pressure aerosols, the straight Freon 12 was diluted with Freon 11, a similar but lower-pressure gas. By varying the proportion of Freon 12 to Freon 11, the pressure of the resulting mixture can be custom-tailored to each type of product to be dispensed. A 50-50 mixture produces a pressure of about 35 pounds at 70° F. A mixture of 70-percent Freon 11 and 30-percent Freon 12 lowers the pressure to about 25 pounds.

Newest gases to be used are General Chemical's recently developed Genetrons. Similar to Freons, they come in half a dozen ready-made pressures to give aerosol makers a wide choice. Food products, like whipped cream, use a combination of nitrous oxide and carbon dioxide because they are odorless, tasteless, non-toxic, and have a high degree of solubility in cream concentrates.

In general, for a concentrate of a given consistency, the higher the pressure, the finer the spray, and the lower the pressure, the wetter the spray. But the amount of gas, in relation to the amount of concentrate, can also affect a spray. A spray that contains a high proportion of gas will tend to be finer than one with a low proportion, since the presence of a greater amount of gas breaks down the particle size.

The size of the valve opening can also affect a spray, but until recently most valves were standardized, with thick paints and thin insecticides coming out of the same nozzle. Now aerosol makers are beginning to fit the valve to the product as carefully as they do the pressure of the gas.

An All-Glass Aerosol?

With 30,000,000 aerosols made in 1949 and an expected 50,000,000 for 1950, tomorrow's squirt bombs promise even better things to come. One may be an all-glass dispenser, if manufacturers can develop an unbreakable container that won't shatter under the pressure or blow up if it's dropped. Besides eliminating corrosion, claim aerosol experts, it would look better and let you see exactly how much you have left.

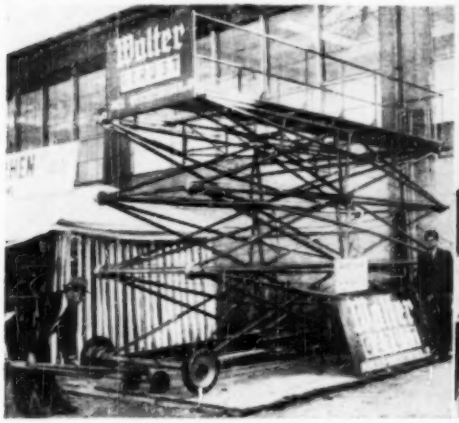
Already, the versatile bombs-of-all-trades have turned up as paints, polishes, cleaners, mothproofers, deodorants, cosmetics—and a disposable blowtorch. There are even sprays to dry out your spark plugs, cure your athlete's foot, protect your silk stockings, and keep neighborhood dogs away from your prize shrubs. Tomorrow you'll be squirting mayonnaise on your salad, meringues on your pie, maybe even catsup on your meat.

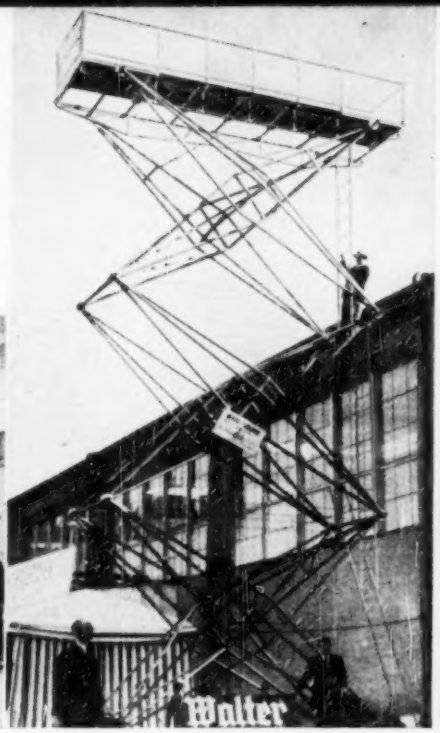
And for the guy who started it all, the mud-slogging foot soldier, there will soon be a pocket-sized, push-button smoke bomb to give him his own personal smoke screen whenever he needs to take cover. END

See Popular Science next month for tips on using new spray-paint bombs in your home.

Folding Scaffold Rises 46 Feet

INVENTED by a Munich tinsmith (who is shown below adjusting the unit's front wheel), this scissors-type steel scaffold folds down to less than 10 feet. A small electric motor quickly raises the working platform to a maximum height of 46 feet (right). The movable, tubular-steel scaffold weighs a little more than a ton.





Crooked Bar Does Many Bending Jobs

THIS odd-shaped steel bar can do a dozen bending jobs around an automobile. It helps turn fender beads, straighten jammed fenders, align bumper arms, and true up clutch or brake pedals. The Multi-Tool is sold by the Martin Quick-Trim Co., of Los Angeles.

Greeting Cards Are Tree Ornaments

THESE Christmas cards do double duty. Containing suitable friendly greetings, the cards are mailed like conventional ones. But when opened up, below, they become glittering three-dimensional ornaments, ready to be hung on the Christmas tree or the fireplace mantel as an unusual decoration. Twirl-Arounds are being introduced by the P. F. Volland Co., of Joliet, Ill.

Test Your Orientation in Your Own Home

With a couple of pieces of cardboard and some luminous paint it's easy to test in your own living room whether you know which way is up. Take an 18-inch square of cardboard and cover a half-inch border with the luminous paint. Cut another piece of cardboard an inch wide and approximately 15 inches long and paint it. Pin or tack both to the wall at the eye level of a seated person, being sure that tack is through center of both frame and pointer. Place a chair, preferably a wing type that supports the head when tilted, in front of frame and tip it about 22° to one side by placing books under the legs. Seat subject in chair with his eyes closed, extinguish lights, and have him open his eyes. Revolve both frame and pointer, bringing them to rest 15° or 20° off center in opposite directions. Ask the subject to direct movement of the pointer so as to make it vertical.

How Do You Know Which Way Is Up?

The answer—which may tell a lot about what kind of person you are—is coming out of a topsy-turvy room in Brooklyn.

By Bill Reiche

PS PHOTOS BY HUBERT LUCKETT

PRACTICALLY everyone, unless deliberately tricked or misled by extraordinary circumstances, knows which way is up—slang expressions to the contrary notwithstanding. In other words, almost all of us can, without any difficulty, hold a ruler in a true vertical position.

Since this is true, it might seem remarkable that the Office of Naval Research is sponsoring an intensive investigation of space orientation in man.

But at Brooklyn College, brains and ingenuity join hands under the direction of Dr. H. A. Witkin, assistant psychology professor, to discover its whys and wherefores. Devilish devices make the subjects appear tilted when they're not, make them feel straight when they're tilted; jiggle their surroundings, whirl them around, and place them in rocking cubes.

The first reason for this investigation is that among the vast variety of Navy personnel some men operate under "extraordinary circumstances" almost as a matter of routine. Flyers, for instance.

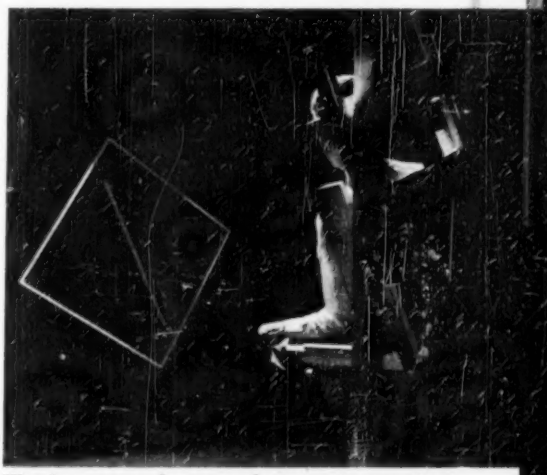
The second reason is that it may lead to a psychological technique that will enable us to know a great deal more about man and why he behaves the way he does.

Competent airmen insist that at times they can fly straight and level and not know, from their own sensations, whether they are upside down or not. Others scoff at this statement, which is psychologically suspect but not scientifically disproved.

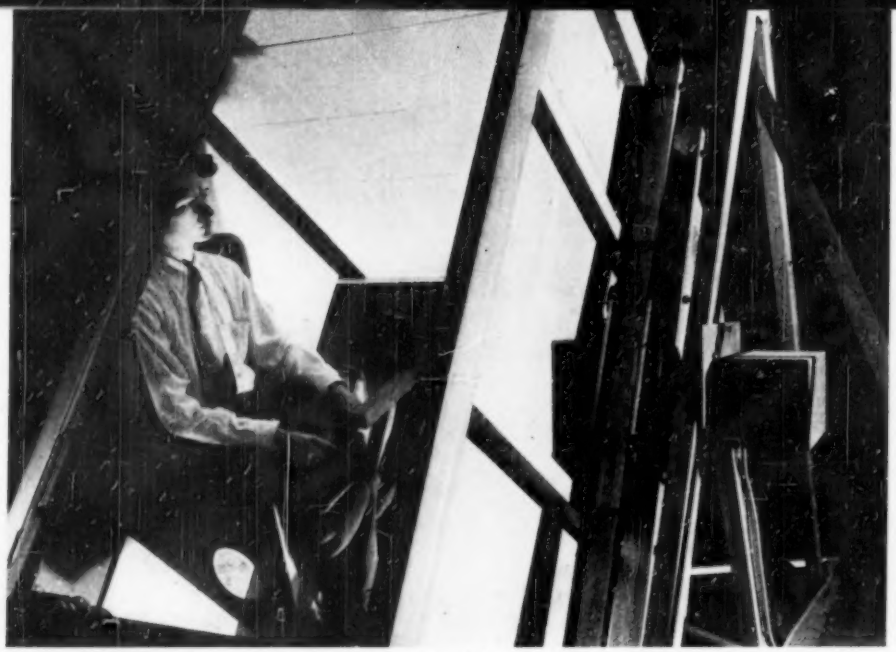
One thing is sure: strange things happen even to experienced flyers that cannot be explained rationally with our present knowledge. For no reason now known, a seasoned pilot may experience vertigo, or loss of bearings, so that he may consider himself vertical when he is even 45° off. In extreme cases the individual literally did not know which was "up" or "down."

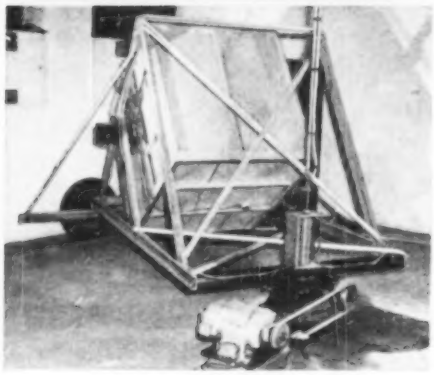
Take the case of Marine Corps Captain X, a senior flight instructor and combat veteran. On a training flight in night tactics he suddenly felt that his ship was peeling off in a steep left-hand dive. Despite the natural urge to use right rudder and aileron to correct the "dive," he believed his instruments, which told him he was flying straight and level. In landing, the field seemed to be tilted some 45° to the left and Captain X narrowly avoided groundlooping when he came in with left wing and left wheel down.

Captain X had enough self-discipline to force himself to believe his instruments,



The home test shown on the opposite page is performed above in Dr. Witkin's Brooklyn College laboratory. This chair pivots a set distance in either direction, has head bracket.





After a fast ride in the whirling room, above, subject is asked to straighten it and himself. He usually misses badly because centrifugal force has influenced effect of gravity as a guide. At left room is shown in extreme tilted position sometimes demanded by subjects.

rather than his own sensations, and survived. But in combat his confusion might well have cost him his life.

We live in a world filled with verticals: doors, windows, walls, trees, and people, to which we are so regularly exposed that they serve as constant reference points of which we are hardly conscious.

It not only *looks* to be an up-and-down world, but it *feels* the same way—for physical and physiological reasons. Gravity is the true vertical; from all points on the earth its force is directed to its center. When standing, our body is supported by a small base, and if we do not remain erect gravity will tend to cause us to fall. When seated, a variation from the vertical is noted in increased pressure on one of the buttocks or by pressure on the arm or body from whatever is supporting us from the side.

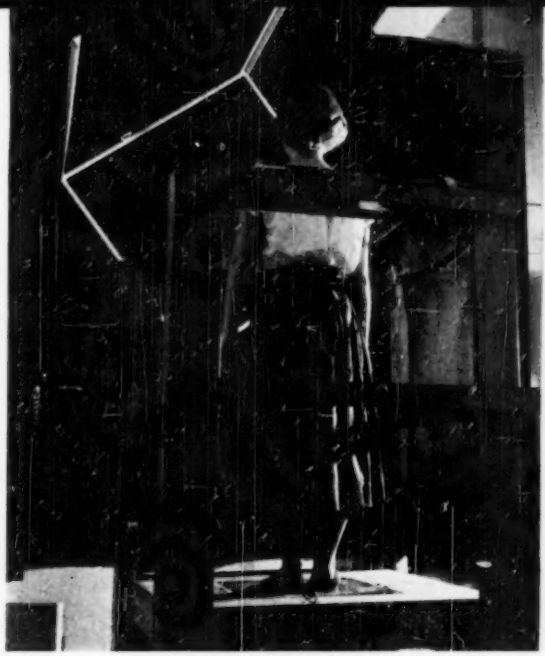
These clues are supplemented by a pair of organs in our ears, called labyrinths. These are partially filled with fluid. When the head is moved to left or right, forward or back, the fluid moves, and we are aware of which way our head has tilted. Sort of carpenter's levels, with movement of the liquid felt rather than seen.

But a pilot, if the horizon is invisible, has no stable vertical reference; the cockpit moves with him; he must *believe* his instruments, often against his own sensations.

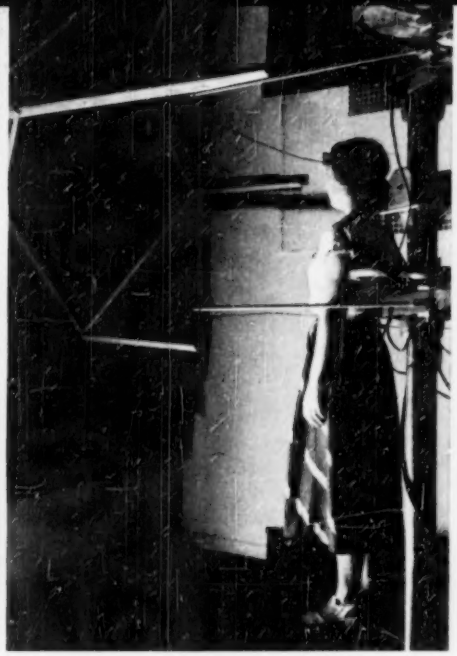
If the flyer is tightly strapped in his seat, the varying pressures on his buttocks and other body areas may be difficult to translate into terms of position.

Separating the Senses

In order to discover the what and why of all this, it was necessary to devise tests that would isolate the visual factors—those that are seen—and the postural factors—those that are felt—from each other. Normally we blend them so smoothly we cannot tell which contributes more heavily to our orientation.



In pitch darkness, the subject attempts to stand still on a tiltable metal plate while a luminous frame rocks dizzily in front of her.



An ataxiameter measures subject's slightest movement as she stands on solid surface with rocking frame affecting her equilibrium.

Three test setups and procedures that provide the conditions under which we can establish how people know which end is up are now in use.

You might try the tilting-room, tilting-chair test. You climb into a three-walled room, about six feet in each dimension, and sit down in a wooden chair that looks like an unsuccessful candidate for the execution chamber. Room and chair may be tilted left or right, together or separately, at the same or different speeds, by the person conducting the test. The subject cannot see out of the room, so he is dependent on his own "feel" and whatever information he can gain from the largely misleading visual evidence provided by the room.

First the room is tilted 56° and the chair 22° to the same side. You are asked to bring the room back to vertical by instructing the operator in which direction and how far to move chair and room. Then room and chair are similarly tilted, but to opposite sides, and you again must try to get the room back on an even keel.

Up to now you've only had to straighten up the room. In the next test the cubicle and the chair are tipped 35° and 22° respectively, in the same direction, and you're asked to straighten yourself up.

In the final trial-by-tilt, the room and chair are tilted as before, but in opposite directions. Again you are asked to bring yourself to the vertical.

How would you have made out? It's difficult to say without an actual test. One man managed to bring the room to an average of 2.5° of variation from the vertical in four trials; a woman, on the other hand, considered it upright at the original 56° tilt.

The average error for men in bringing the room to the upright was 22.9° and for women 28.1°. When the men considered their bodies vertical they were off an average of 8.2°; women missed by 10.3°.

Seeing Is Not Believing

The greater error in straightening the room than the body is hardly surprising. More people stand straight than can hang pictures evenly. This test measures the individual's perception of his own body and the surrounding field in relation to the vertical.

Note how much these results tell about the individuals. The man who could bring the room to the near-vertical depended almost entirely on what he felt posturally, since everything he could see was misleading. The woman who called the room ver-

tical when it was 56° off was dominated by the visual factors—she depended so strongly on her surroundings, what she saw, that she ignored the postural factor entirely and made the greatest error possible.

Now you are taken into a darkened room to check your perception of a single item in a field. A luminous square frame, about the size of a bridge-table top, surrounds a luminous rod. Both are pivoted. All the subject can see is the frame and the rod.

The subject and frame are tilted 28° in the same direction and the rod is to be returned to vertical from a position 28° off vertical. Next the subject and frame are tilted in opposite directions, and finally the body is erect and the frame tilted.

The influence of the visual factor again appears to be demonstrated when subjects tried to straighten things out. With body and frame tilted in the same direction the average error for men was 12.5°, for women 16.7°. Tilted in opposite directions, the sexes went astray 14.5° and 18.3°, respectively.

When the body was erect, and could serve as a guide in bringing the rod to the vertical, the average error was 7.4° for the men and 12.1° for the women. The tendency to believe that a field must be vertical—or nearly so—since it is in everyday experience, is a difficult one to overcome, regardless of contradicting collateral evidence.

So far, while the body has been tilted, gravitational force has been constant and helpful if the subject could interpret it. But gravity has a horizontal cousin, called centrifugal force, that can influence his kinsman when they go around together. This is done in the rotating-room test, a fine bit of psychological trickery that involves a tilting chair, a tilting field, and an ability to put gravity locally out of whack.

"Lookers" vs. "Feelers"

The room is fully enclosed and mounted on a carriage that is driven around a circular track. The subject is whirled about with both room and chair vertical and asked, via telephone, to straighten the room. In a subsequent run, under the same circumstances, he is asked this time to bring the chair to the vertical.

At the rate the room was moving, centrifugal force altered gravity to the extent that the force on the body was 39.9° off the true upright. Gravitational force, instead of being straight down, had moved almost half way to the horizontal. The extreme visual type would demand no adjustment of room

In the auditory-visual conflict test the subject, background, sees the tester's face directly before him in mirror, but his voice "moves." Subject is asked when it "moves," and which way.

or chair, since they were upright and looked it. In extreme cases of the postural type, they had the chair moved to a position at right angles with the force, cancelling it out entirely, and making the subject believe himself upright from the standpoint of feel.

In related tests, the same general tendencies are revealed. In one test, the subject stands on a tilting metal plate in pitch darkness. The outline of a luminous cube rocks back and forth about him. Instruments measure how much he loses his balance and the intervals when he must hold a support. Then, while standing on a solid floor an ataxiameter (an instrument for measuring involuntary unsteadiness of bodily position) measures the body's sway as a cube rocks before the weaving subject. In an auditory-visual conflict test the subject sees the tester's face directly before him, but his voice "moves" to right or left by means of controls. The subject must tell when he notices the voice "move," and its direction.

Immediate goal of the ONR studies, still far from completion, is to reveal what happened to Captain X, and to guard Lieutenant Y and Major Z in the future. But they will also lead to greater knowledge about how the individual perceives the world and himself.

The psychological conclusions are far from complete, but general information has come to the surface that promises the development of valuable techniques.

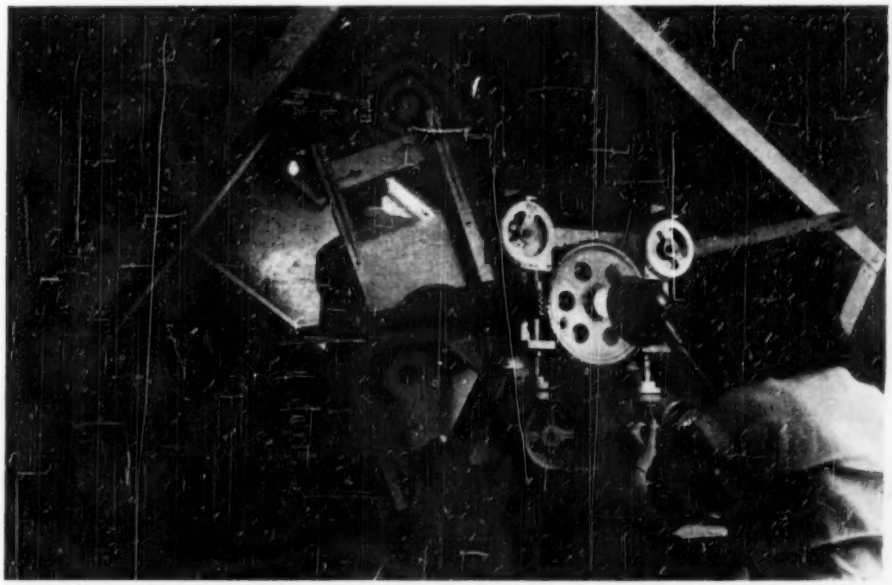
Strong reliance on the postural factor may be a danger signal indicating one of several psychological leanings. The hurt child becomes self-centered, full of suspicion and distrust, and in his indifference to the world relies on how *he* feels. This type may develop into a man who is extremely self-centered and self-satisfied. He will show his disregard for the world and satisfaction with his own capabilities by almost ignoring what he sees in favor of what he feels. The same applies to the person whose difficulty in dealing with the world causes him to withdraw into himself.

Extremes Cause Trouble

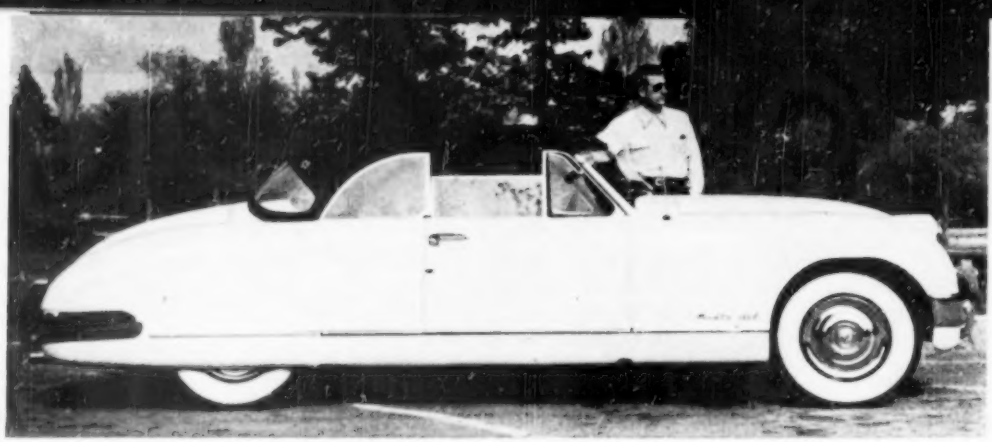
Sensitivity to the visual factor is seen in the insecure individual, who is hypersensitive to the standards of the world.

The extreme type, either way, is in trouble.

The results of these tests are not final answers, but components in the great mosaic of psychological testing, that may help us one day to understand the most important device in the world—man. END

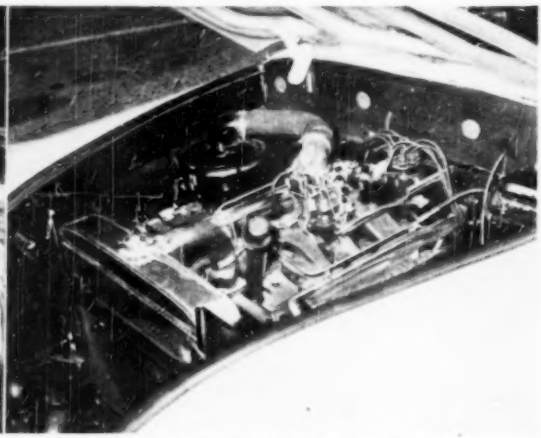


With subject tilted 22° left and room 56° right, he is asked to bring the room back to the vertical. If he is fairly successful, it indicates he judges mainly by feel, since sight is no help.



Low lines, pronounced windshield slant give Road-Jet fast, sporty look. Car is 4½ ft. high.

Roomy trunk, 47 inches wide and 44 inches deep, has carpet on floor. Wrap-around bumpers at both front and rear, set into body panels, are integral with frame for strength.



Powerful engine is stock 160-hp., 8-cylinder Cadillac, with Hydra-Matic drive that eliminates clutch pedal. Special engine suspension is designed to give good roadability on fast turns.

$5,000 Sportster: Long, Low, Full of Gimmicks

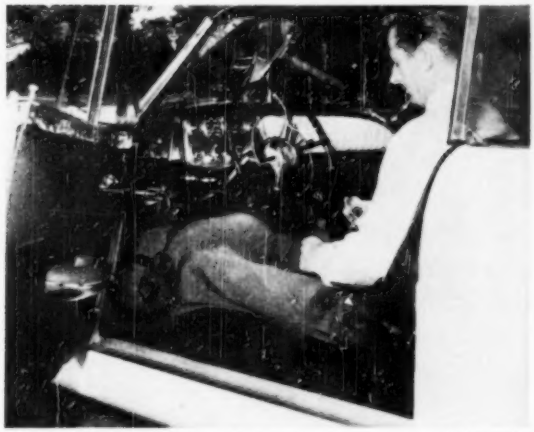
THE Kurtis sports car, once sold as a build-it-yourself kit (PS, May '50, p. 136), has gone de luxe. Now called the Muntz Road-Jet, the low-slung, sporty coupe will soon be offered as a semi-custom job by West Coast promoter Earl "Madman" Muntz, who expects its 160-hp. Cadillac engine to help it sell.

Standing only 54 inches high, the 178-inch, spruced-up speedster is 13 inches longer than its predecessor, but retains the same sleek, low lines. Gadgets galore include a crash-padded dash, safety belts, and built-in ice boxes. The car will hit 125 m.p.h.

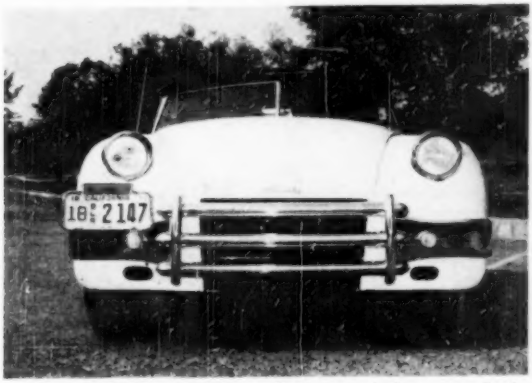
A welded-steel frame covered with aluminum body panels is said to provide high strength at low weight. The car uses coil springs in front and leaf springs in the rear. Both exterior and interior will be finished in colors of the customer's choice.

Priced at $4,995, from the Kurtis-Kraft plant at Glendale, Calif., the five-passenger "Convertacoupe" has an all-metal, French-type top, removable for open driving.

Armrest dividing front seat also serves as ash tray and glove compartment. Two similar armrests on both sides of rear seat contain ice boxes to keep beverages cold. Note safety belt.



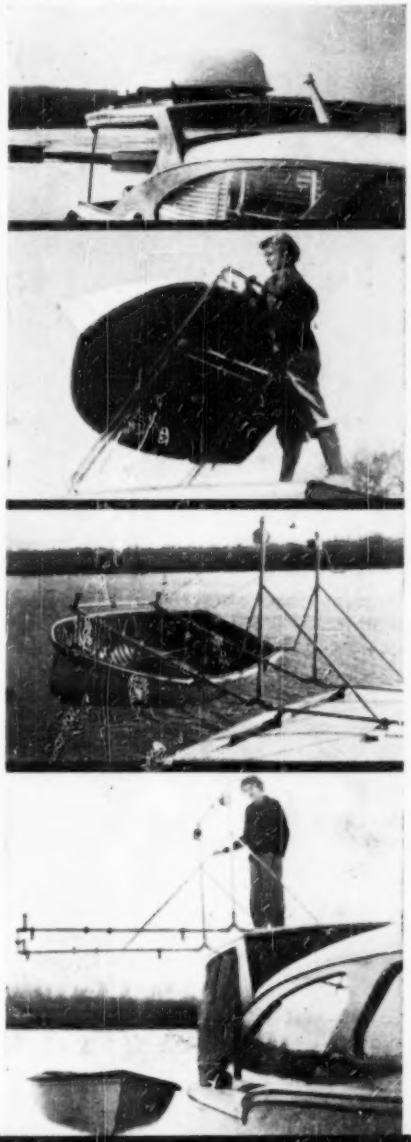
Aircraft-type instruments are grouped directly in front of driver, include tachometer, oil-temperature, and vacuum gauges. Right side of dashboard is padded for crash protection.



Head-on view emphasizes car's low, racy look. "Convertacoupe" model shown has plastic top, but production version will have metal French type. Car weighs 3,300 lb., has 113-in. wheelbase.

Hoist Launches Dinghy Fast

One person can move a dinghy in 60 seconds from its stowage place to water with this aluminum hoist. First the rig is pushed up to a vertical position. Then a crank is turned and the arm that holds the boat drops out over the water. The dinghy is lowered on cables attached to both ends. Steps in the launching are shown below, from top to bottom. To raise the dinghy, the procedure is reversed. Called Doist, the launcher is made by the Diamond W Mfg. Co., Schenectady, N. Y.



Here's Your Color TV

To convert this Zenith to color, CBS engineers added adapter in back, filter disk in front.

It means new entertainment—and new problems—for everyone who owns a set or is thinking of buying one.

By Martin Mann

AFTER 10 years of spiteful, even vicious, squabbling, color television is here. Columbia Broadcasting System is set to start TV shows this month in realistic, full color, using its own "field-sequential" method. It is this method that has won the official blessing of the Federal Communications Commission as *the* U. S. color TV system.

Your receiver, like the rest of the 10,000,000 already built, can't receive these shows. It will get either a blur or several small pictures side by side when tuned to color TV.

But you needn't stay out of the color picture long.

Manufacturers of some sets will have color attachments for their own sets on the mar-

Despite the FCC's "final" decision in favor of CBS color, many TV manufacturers are continuing their fight against it. They have started legal action that may delay the timetable set for color. It'll probably take a ruling from the U.S. Supreme Court to put a stop to the wrangling once and for all.

ket in a few weeks. Several firms have also promised to offer adapters and converters for other makes of sets soon.

An *adapter* hooked to your set clears up the screen so that you can see the colorcasts in black-and-white, but not in color. Probable cost: at least $35.

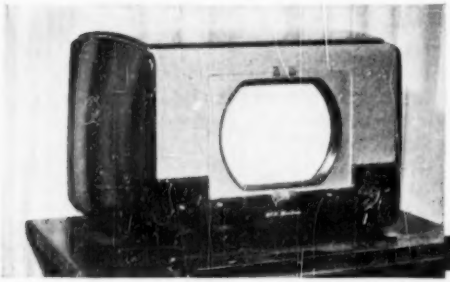
A *converter,* which includes an adapter plus a spinning color disk, brings you the whole thing—full-color pictures. Probable cost: at least $110. You may be able to convert your set yourself at less cost, but that depends a great deal on the set (see p. 120).

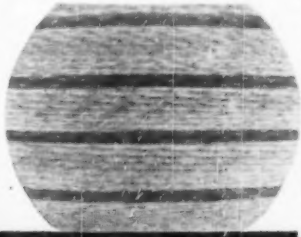
It'll probably be summer at the earliest before new sets, with color built in at the factory, reach the market. Prices should start around $300 for a combination color and black-and-white set with a 10-inch viewing tube magnified by a lens.

So far, only two stations in the country—New York's WCBS-TV and Philadelphia's WCAU-TV—are definitely committed to transmit color. And they will start with no more than 20 hours a week, mostly at off-hours times.

These shows will be available to any of the other 61 Columbia network stations that want them and are connected to New York by coaxial cable or microwave relay. Anybody else who wants to telecast color can

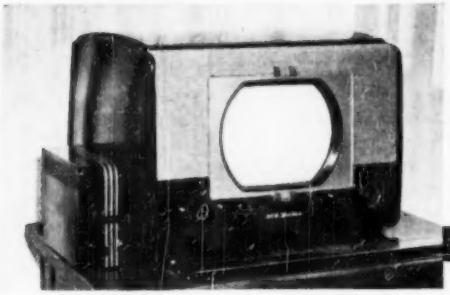
WHAT CAN YOU DO WITH THE SET YOU HAVE NOW?





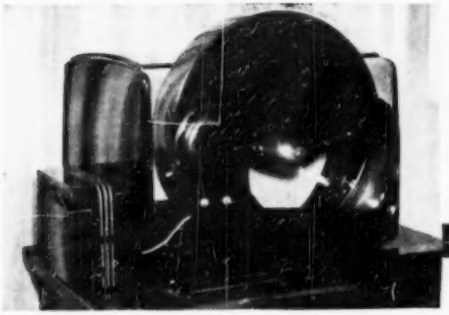
LEAVE IT ALONE

This blur is what most existing TV sets will get when tuned to a CBS colorcast. Some others may show several small pictures side by side. The reason today's sets can't get color shows is that technical standards were changed for color. Of course, old sets still receive black and white.



INSTALL AN ADAPTER

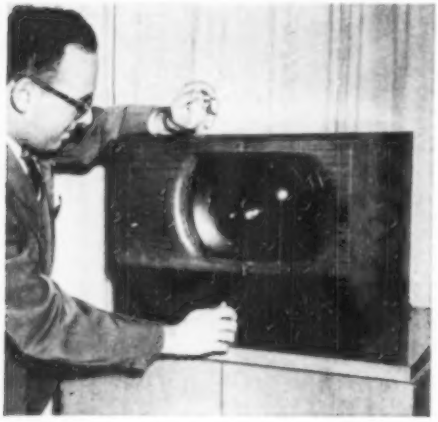
An adapter—the black box at the far left in the photo—brings in a clear, single picture from colorcasts. But in black and white, not color. The adapter is actually an extra electronic circuit that changes the works of your set to make them conform to the new color standards.



INSTALL A CONVERTER

Here's color. Adding a motor-driven color disk to the adapter does the trick (these two units together are called a converter). The disk puts red, blue, and green filters in front of the tube in exact step with similar filters in the TV camera, creating the illusion of full color.

When sets with the color built into them become available—probably in six months or so—they may look like these experimental models designed by CBS engineers. The color disk is completely enclosed, folding aside when the receiver is switched to black-and-white telecasts.



buy color cameras and originate his own.

How quickly colorcasting will spread—to more popular hours and to more stations—depends on how quickly the public buys sets that can receive color. The same show can *not* be broadcast in color and in black-and-white at the same time. It's certain to be several years before the big majority of the top programs are broadcast in color.

So there's no reason to junk your present set. But if you don't own a TV receiver now and are thinking of buying one, the decision becomes more difficult. You can go ahead and buy the black-and-white set and be sure of several years of fine entertainment. You can probably add an adapter or a converter when you want to. On the other hand, you can wait—meanwhile missing a few months' shows—for a set with built-in color or one with a built-in adapter.

The reason for all this confusion over adapters, converters, built-in color, and black-and-white sets lies in the system of color television the Federal Communications Commission selected. This system is simple, comparatively inexpensive, and gives good color, but it does upset the applecart of present-day TV—it cannot be received by existing black-and-white sets.

To understand why, look closely at a black-and-white TV picture. You will see that it is not a smooth blending of light and dark tones, like a photograph, but is actually composed of 525 individual lines of varying shades of gray. The camera creates these lines by running its electron beam across the scene from left to right, then turning the beam off while it is moved back to the left and down to the next line, then on again while it "scans" this line. During one trip from top to bottom, half the lines (one "field") are scanned. Then the beam goes back to scan the in-between lines it had skipped. Two fields, making one 525-line "frame," are sent out 30 times a second. The same thing occurs in a receiver, the frames following each other so fast they merge.

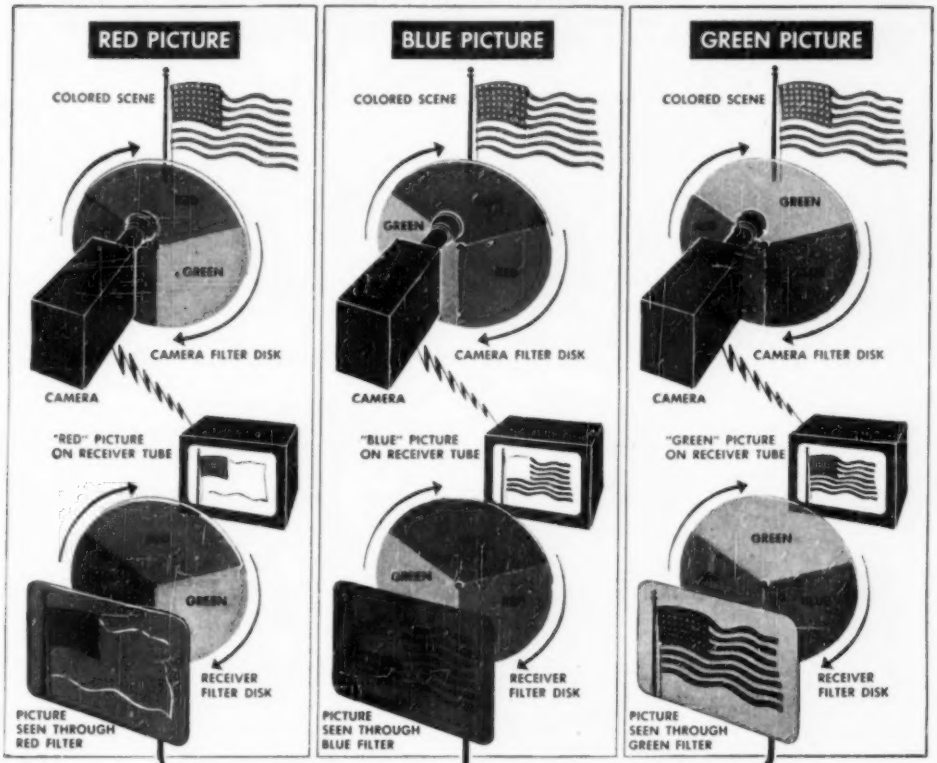
CBS Color Needs More Fields

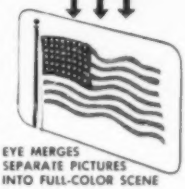
The CBS color technique works much this way. But the first field is made with a red filter behind the camera lens, the second field with a blue filter, the third with a green filter, and so on. In all *six* fields—two each of red, blue, and green—are needed to make one full-color frame. Again the same thing occurs in a receiver. The fields—each viewed through the correct filter—follow each other so fast they merge into moving, full-color.

Unfortunately, you can't just start transmitting three times as many fields as you did before. (You can't, that is, without taking up more space in the crowded airwaves, and this isn't feasible.) If you increase one part of the load by tripling the number of fields, as CBS color does, you must decrease some other part to compensate. CBS compensates by reducing the number of lines and frames. The lines are cut from 525 to 405, and the frames are cut from 30 per second to 24. (Though this coarsens the picture, the color more than makes up for it.)

These changes cause the trouble. Existing

HOW CBS COLOR TELEVISION WORKS





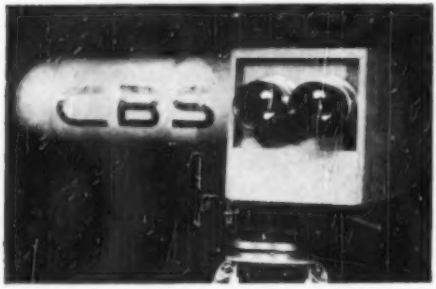
Color TV actually transmits a series of black-and-white pictures, each made through a colored filter. These appear on the viewing tube in black and white, gaining their color only because you look at them through a filter like the one on the camera. The drawing above (which shows equipment simpler than that actually used) explains how a U. S. flag is televised. Light from red stripes can pass only the red filter, so a signal for red stripes is transmitted only when the red filter is in position. This signal creates a white area on the receiver tube, which is colored red by the receiver filter. The blue is sent in a similar way. Light from the white stripes and stars passes all filters, so you see a quick succession of red, blue, and green, which blend to make white.

receivers are designed for 525-line, 30-frame TV. Their deflection circuits move the electron beam back to the left 15,750 times (525 x 30=15,750) a second and to the top 60 times (for 30 two-field frames) a second. For color, the electron beam must scan 405 lines in three colors 24 times every second, moving to the left 29,160 times (405 x 3 x 24=29,160) a second and to the top 144 times (for 24 six-field frames) a second.

Changing the deflection circuits so that the electron beam moves at these new rates is what is involved in adapting a black-and-white receiver to color standards. In many sets, this is extremely simple, requiring no more than the replacement of a resistor or two. But in others, particularly more elaborate ones with "locked" deflection circuits that keep the picture very steady, extensive changes may be needed. Adapted black-and-white sets also need a switch—automatic ones have been invented—to cut the new circuits out for old-style black-and-white.

Receivers adapted in this way will show

Several different types of lightweight color cameras have been developed. The one above, shown being focused on model Patty Painter, has also televised surgical demonstrations.



Another style of color camera used by CBS for its experimental telecasts is shown above. Most cameras do not use filter disks, but have vari-colored drums rotating behind their lenses.

colorcasts, but only as black-and-white pictures. To add the color itself, you need a rotating filter disk in front of the screen.

This complicates things still more. The receiver disk must rotate exactly as fast as the camera disk or the colors will wash out. It must also be "in phase"—red in front of the viewing screen when red is behind the camera lens—or actors may have green faces and blue lips. Simple circuits, synchronizing receiver and camera disks the way receiver and camera tubes are now synchronized, can accomplish this dependably.

The disk also limits the size of the direct-view picture to about 12½ inches. The disk obviously has to be twice the diameter of the viewing tube, and few people would want disks bigger than two feet across in their living rooms.

Since the change-over to this color system raises so many problems, why did the Federal Communications Commission pick it? The answer is simple. The Commissioners felt it was the only good one!

Four different systems were suggested, but the real contest arose between Columbia's and RCA's. The RCA method had the big advantage of being "compatible"—it required no change in deflection rates and could be received on existing sets (in black and white) just as they are. This would eliminate the big change-over problems: TV fans wouldn't miss any shows even if they didn't want to alter their sets, and telecasters wouldn't lose any audience by shifting to color.

But overriding the compatibility advantage, the FCC found many serious faults with the RCA system. To quote a few from the Commission's 59-page official report, "the color fidelity is not satisfactory . . . the picture was marred by misregistration (colors failed to superimpose properly) . . . at none of the demonstrations was a practical home receiver shown . . . no practical converter (for putting color—not just black and white—on existing sets)."

Report Praises CBS Color

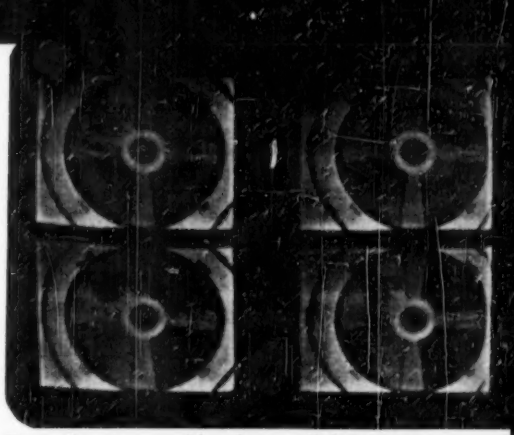
The FCC's reaction to CBS color was just the opposite. Again quoting from the official report, ". . . a color picture that is most satisfactory . . . receivers are simple and should be within the economic reach of the great mass of purchasing public . . ."

But why did the FCC have to approve any system now? Why couldn't the color decision wait until RCA's compatible system was improved? The Commission said a *good* compatible system might never be developed. And delaying the decision while more and more black-and-white sets were built would only make it harder—or even impossible—to adopt a noncompatible system like Columbia's.

Although the FCC has settled for a long time to come the standards for color television, improvements in the system are already on the way. Many laboratories are working on the three-color tube (PS, June '50, p. 108), which can be used with the Columbia technique. This tube would eliminate one of the main objections to CBS color—the cumbersome filter disk that limits the screen size.

Meanwhile beautiful color is here. For a reasonable investment of money and effort you can start enjoying it right now. END

Your 7-Incher Can Catch Color Telecasts



Four tiny images like these will bob up on the screen of nearly every 7-inch TV set when it is tuned to a channel carrying CBS colors. Bigger conventional sets may just get a blur.

Adding two resistors will adapt a little set to the new standards, but you will need a wheel to enjoy the colors.

By Norman L. Chalfin

THE easiest sets to turn into color television receivers are the little 7-inchers.

- Adding two resistors will adapt these small sets to the CBS standards and enable you to see black-and-white versions of the color broadcasts.
- Adding two hold controls and a switch will then enable you to receive both standard black-and-white telecasts and black-and-white images of the CBS colorcasts on the same set.
- Placing a color wheel in front of the 7-inch screen of a set modified in these ways will enable you to see the broadcast in color.

Adapting a larger set to the color standards may entail much more work and possibly replacement of some major parts. The color wheel needed to obtain larger color pictures is also more cumbersome.

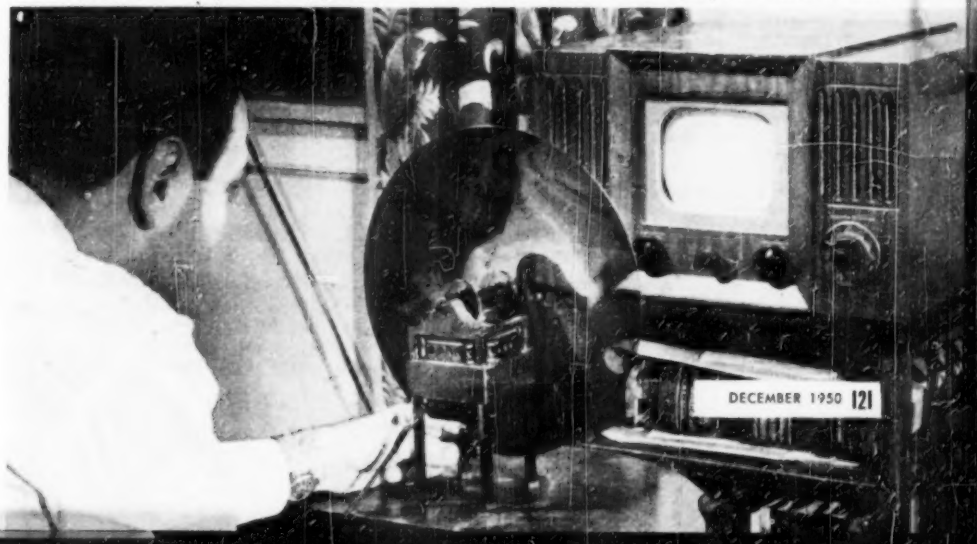
Many 7-inch sets have been shunted aside or traded in by purchasers of the more popular big-screen sets and are now available at much lower prices than the big sets. So this makes them the logical choice for anyone who would like to try his hand at turning a black-and-white receiver into a color set.

The Deflection Circuits

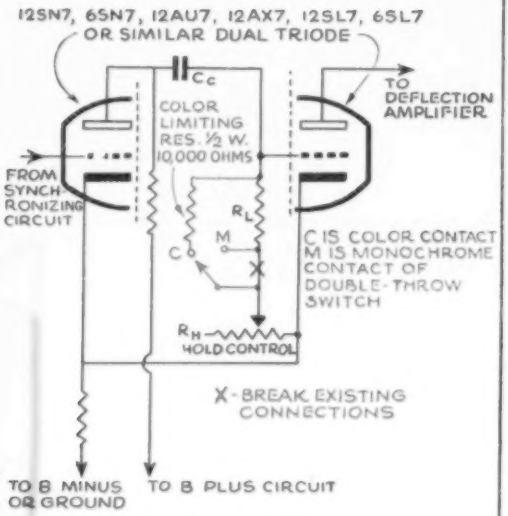
Every TV receiver contains two deflection oscillators—the circuits that move the electron beam horizontally and vertically. In all 7-inch sets, they are either multivibrators or blocking oscillators—although they often are referred to by other names, such as "sweep generators," "sweep oscillators," and "saw-tooth generators." Putting a new resistor that has a lower value into each oscillator will change the sweep frequencies to correspond with the color standards.

Identifying the deflection oscillators in

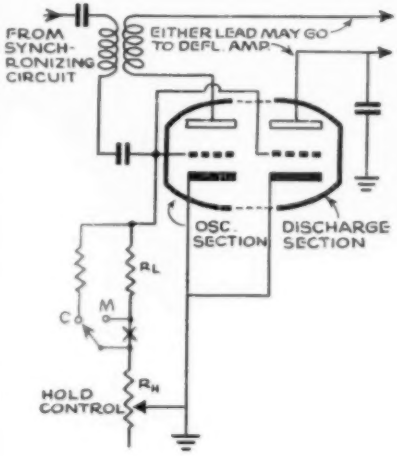
The author sees color pictures by placing this $20 wheel in front of his adapted 7-inch TV set.



DEFLECTION CIRCUITS LIKE THESE ARE USED IN 7-INCH SETS



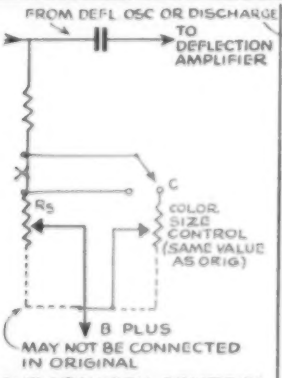
MULTIVIBRATOR
(HORIZONTAL OR VERTICAL)



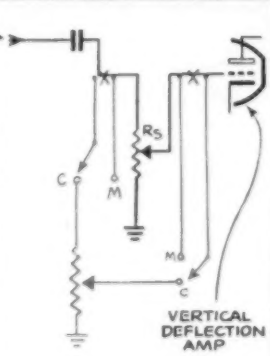
BLOCKING OSCILLATOR
(HORIZONTAL OR VERTICAL)

Colored lines show where resistors can be added, and switch cut in so set can be used to receive either monochrome or color telecasts. Every set has two deflection circuits. Both must be changed. One may be multivibrator and the other a blocking oscillator, or both may be the same. These are typical circuits; yours may differ in some respects. Consult your set diagram.

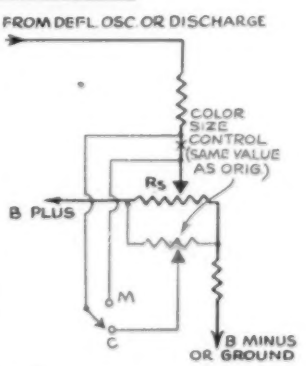
SIZE-CONTROL CIRCUITS LIKE THESE ARE USED IN 7-INCH SETS



HEIGHT OR WIDTH CONTROL
(B PLUS TO OSC PLATE)

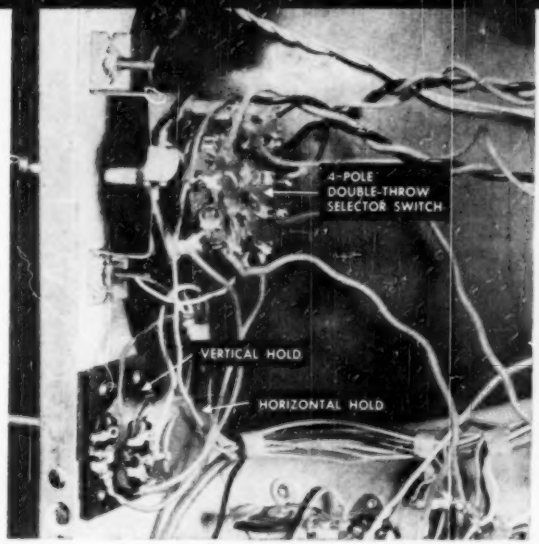


HEIGHT CONTROL IN
GRID OF VERT. DEFL. AMP.

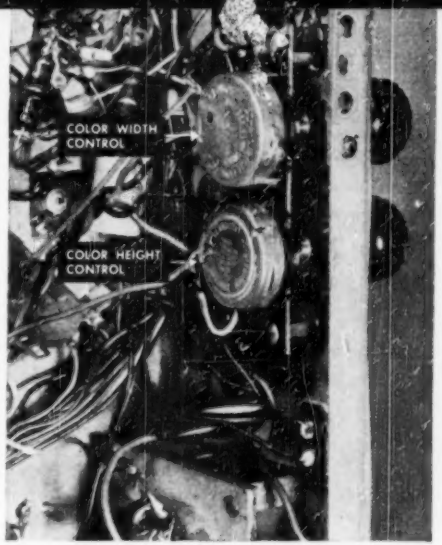


HEIGHT OR WIDTH CONTROL
IN B-PLUS BLEEDER

New controls must be added to avoid readjusting picture size whenever you switch from monochrome to color. Your height control may be any one of these three types: width control may be either of two so marked. Minor variations not indicated in drawings can be disregarded. If your set has height control shown in center you will need an extra switch pole.



Color switch put on front of Tele-Tone 149 by author is 4-pole, 2-position flat wafer. Its shaft goes through cabinet to a small knob centered directly beneath the 7-inch screen.



Size controls for color pictures are mounted on plastic strip, attached to rear apron with spacers, directly below monochrome controls. Once set right, they seldom need be changed.

some sets, however, is difficult. The best way to locate them is to consult a schematic wiring diagram—*but be sure it is the right one*. There are variations even among sets bearing the same model number. So, if you ask the manufacturer for a diagram, you should give him the serial number as well as the model number of the set for which you want it.

In most cases the central part of the oscillator circuit will be a dual-triode tube. Trace the connections, however, before you make any changes. It is dangerous to work on a TV set without being sure what you are doing.

Look For These Circuits

A basic multivibrator circuit is shown alongside a blocking oscillator circuit on page 122. In the multivibrator, both halves of a dual triode are used. Energy is exchanged between them through interconnected cathodes. The frequency of this oscillation depends on the capacity of the coupling condenser (C_C) and the combined resistance of the limiting resistor (R_L) and the variable resistor hold control (R_H).

A blocking oscillator requires a transformer. Opposite windings of this transformer are connected to the grid and plate of a triode. In most sets this is a dual triode, one half of which serves as the discharge section. The two grids then are tied together. The hold and limiting resistors are usually in the grid circuit, and the rate of oscillation depends on the values of the coupling condenser (C_C), the grid resistance (R_L plus R_H), and the impedance of the transformer.

Switch Is Helpful

To change the frequency of oscillation in either a multivibrator or blocking oscillator circuit, you have only to change the value of one of the parts that determine it. (You do this, incidentally, every time you adjust your set's vertical or horizontal hold control.)

The simplest way of doing this to adapt a 7-incher to colorcasts is to reduce the resistance of the limiting resistor (R_L). This can be done by substituting a 10,000 ohm, ½-watt resistor for it. If you place a double-throw switch between the limiting resistor and the hold control, you can then throw this switch one way (M) and get monochrome pictures as usual and throw it the other way (C) and get color pictures—assuming you use a color wheel.

The picture-size controls will have to be readjusted whenever you switch from monochrome to color programs, however, unless you also put in a new set of size controls. The colored lines on the diagrams at the bottom of page 122 show how these can be put in. They should have the same resis-

tance as the size controls already in the set.

You may have to experiment a bit to find the control settings at which both color and monochrome images fill the picture frame properly. But once you've found them, no further adjustment of the size controls should be needed. I placed mine on the back of the set, and connected them to the color switch on the front, so that simply turning this switch gives me either monochrome or color images.

Color Requirements

The most difficult part of the job is likely to be identifying the parts accurately. After that, make sure that you connect all pairs of switch contacts so they operate in the same direction. Then one switch position will bring all color poles into the circuit and the other will close all monochrome contacts.

Once you have adapted your set in this way, you will probably want a color wheel. It should have six equal wedges of transparent colored material. Two wedges should be red, two blue, and two green. If you can synchronize such a disk so that each wedge is in front of the tube for 1/144 of a second, your eye will mix the three colors into every hue of the rainbow.

The simplest one I've seen is the $20 Celomat "Vue-Scope" shown in the photo on the first page of this article. It is simply a three-color wheel, a motor, and a speed regulator, which you can set in front of you and look through. You have to adjust the speed-control frequently, however, because it does not contain any device to keep it synchronized with the pictures.

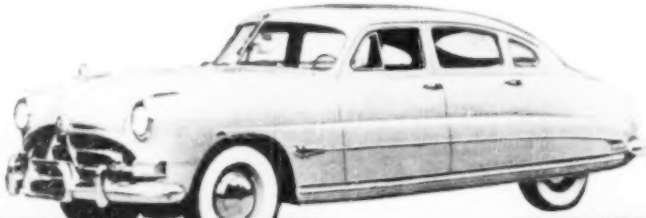
More such "converters" will probably be available soon. END

Hudson Adds New Hornet Series, More Powerful Engine

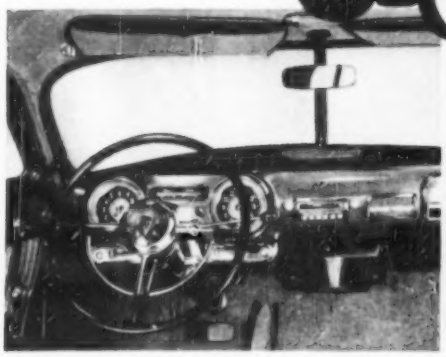
LATEST addition to the Hudson line is this fast, new Hornet series, powered by a 145-hp., high-compression (7.2 to 1) engine. This is said to be the most powerful six-cylinder auto engine now in production.

Standing only five feet high, the new Hornet continues the recessed, "step-down" floor, providing greater headroom at a lower roof line and center of gravity.

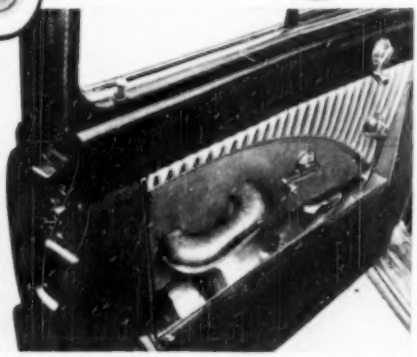
Also new in Hudson's 1951 line is the provision for Hydra-Matic Drive as optional equipment in the Hornet and Commodore Custom series. The Super Custom and Pacemaker Custom also offer Super-Matic Drive.



New Hudson Hornet stands 5 feet high, has clean-cut louvered grille. Stainless-steel rub rail running from front to rear wheels helps prevent marring body. Wheelbase is 124 in.



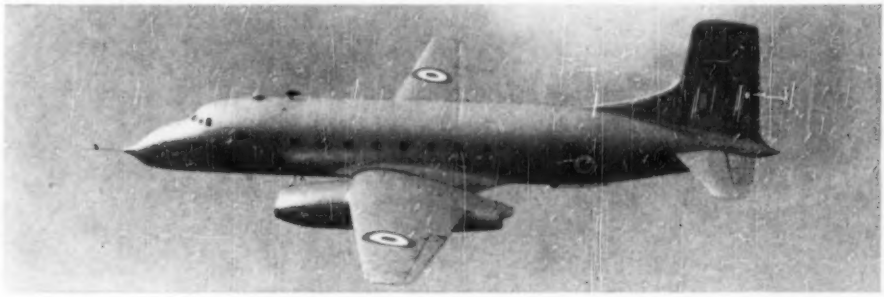
Instruments are grouped directly in front of driver, easily visible through spokeless top half of steering wheel. Right-hand side of dash is cut high to provide plenty of knee room.



Window controls, door pull, and ash trays are recessed into door panels, increasing elbow room by 2 in. and eliminating projections. Front and rear seats are both 64 in. wide.

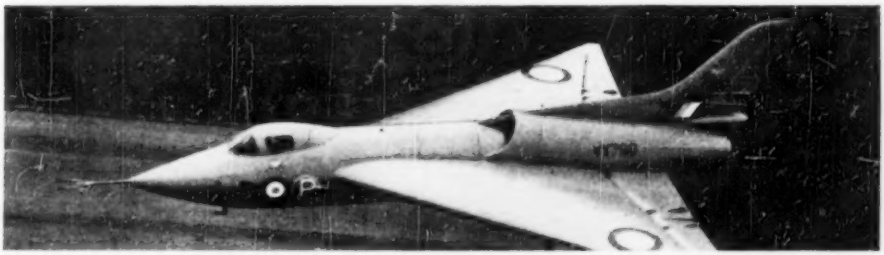
Britain Shows New Planes: Twins Offer Choice of Engines

THESE anti-sub planes, developed for the Royal Navy by Blackburn and General Aircraft, are identical twins—except for their engines. The nearer one, designated Y.B. 1, is powered by a double turboprop unit; the other, Y.A. 5, by a piston engine.



Big Jet Lab Flies High and Fast

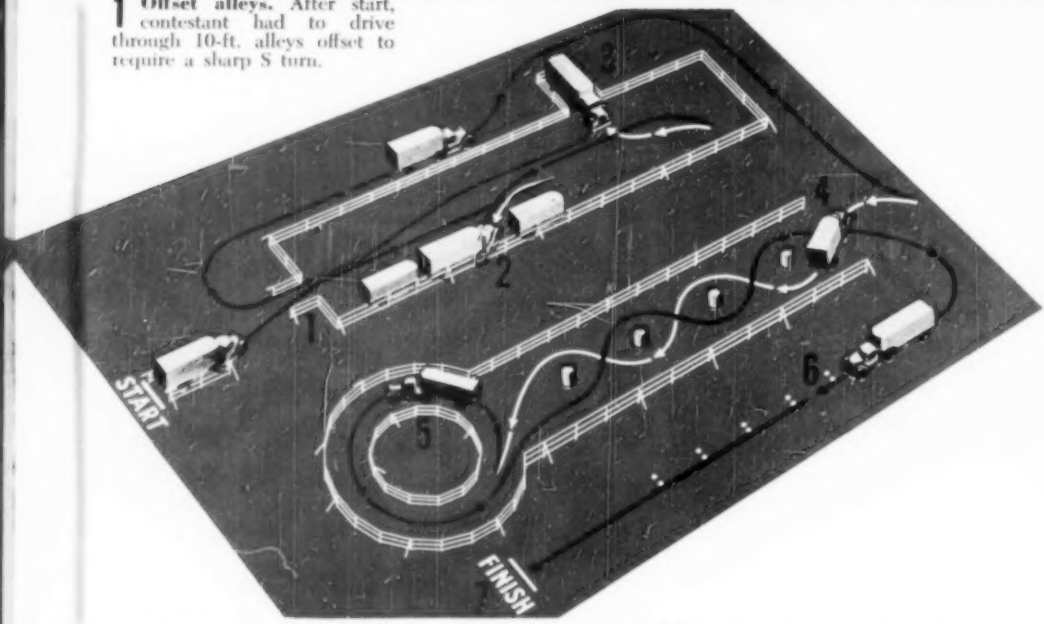
THE big British Avro Ashton above—90 feet long and with a 120-foot wingspan—is a pressurized laboratory for studying the problems of high-speed and high-altitude jet transport and bomber design. One of six recently ordered by the Ministry of Supply, the plane has a speed of 400 m.p.h., provided by four Rolls-Royce Nene Turbojets.



Flying Triangle Tries Its Wings

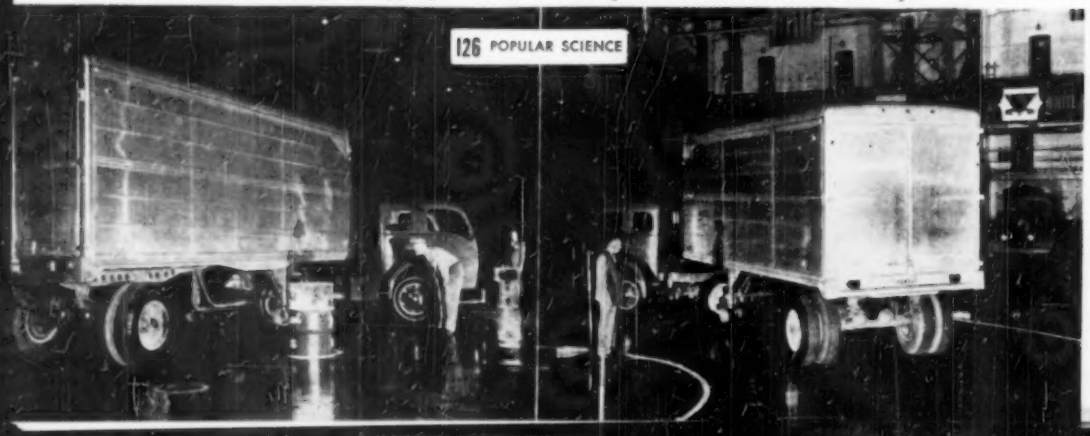
BRITAIN, like the U. S., is experimenting with jet-powered, delta-wing flight. This Avro 707B carries automatic observers, movie cameras, and other research equipment. Opening in top center of fuselage is air intake for the Derwent engine. Cylinder at base of the tail contains an anti-spin parachute that also can be used to slow landing.

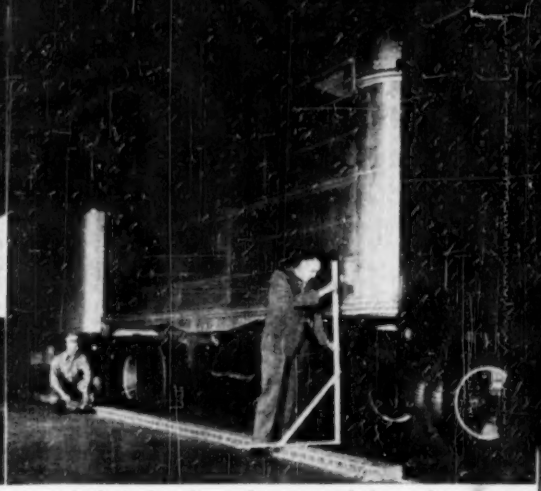
1 Offset alleys. After start, contestant had to drive through 10-ft. alleys offset to require a sharp S turn.



4 Serpentine consisted of four barrels. The contestant had to snake his big semi-trailer first backward and then forward between the barrels without jockeying or stopping.

5 Circle tested driver's ability to wind his tractor-trailer around a sharp turn like those found in most "go-arounds." Markers were placed to allow little room to spare.



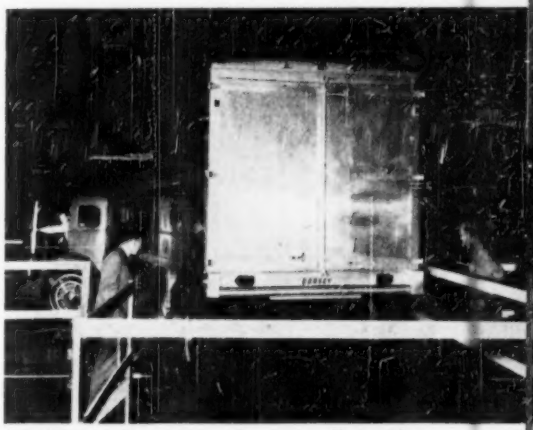


2 Parallel parking. To succeed here, driver had to park his trailer between two other trucks in space only 4 ft. longer than the trailer. Straight trucks got 6 ft. to spare. When parked, the vehicle had to be within 6 in. of the curb or the driver lost points for every inch over. He also lost points if he had to jockey his vehicle more than once.

Precision Driving Wins Truck Roadeo

PS PHOTOS BY W. W. MORRIS

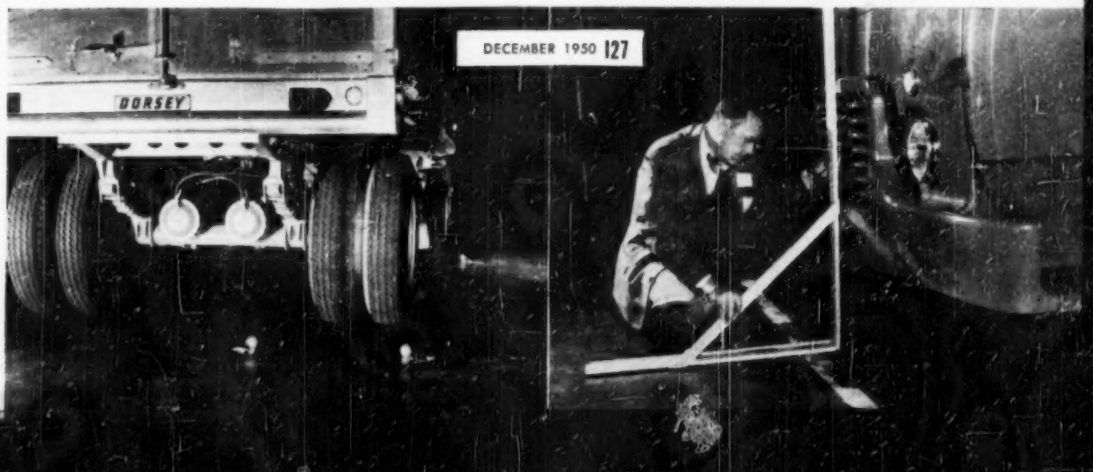
FOR three days recently, 92 truck drivers from 30 states maneuvered big trucks around a tricky obstacle course in a New York City armory. They were contestants in the annual National Truck "Roadeo," sponsored by the American Trucking Associations, vying for honors as the nation's top drivers in four classifications—straight truck, single-axle semi-trailer, tandem-axle semi-trailer, and truck and full trailer. Map at left, and photos numbered to pair up with it, show what they had to do to win. END



3 Alley dock represented narrow alley with a loading platform at the end. Driver had to ease trailer into the 10-ft.-wide alley without touching and stop within 6 in. of end.

6 Straight-line test consisted of double row of balls poised on tees so slightest touch knocked them off. Contestant had to run right wheels through without touching them.

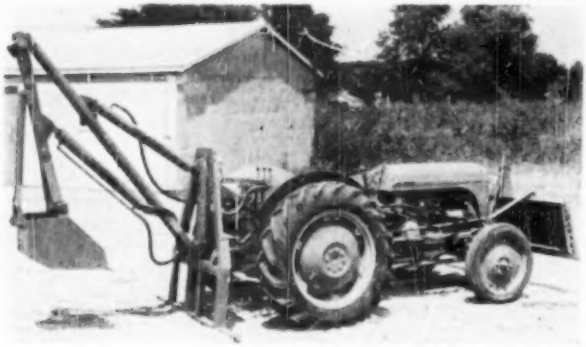
7 At finish, driver had to stop his vehicle within 6 in. of stop line. To qualify, he also had to complete the course in less than 10 minutes. Time affected final score.



Motor Scooter Tows Sea Scooter

TOWED to the water's edge behind a motor scooter, this miniature Italian motorboat (left) can be hand-launched by its two passengers. They just lift it off the trailer and into the drink. The tiny craft, weighing only 220 lb., has a top speed afloat of 8 m.p.h. and carries enough fuel for a 5-hour cruise. It sells in Rome for about $480 —without the towing scooter and trailer.

'Dozer-Digger Fits Tractor for Contruction Jobs



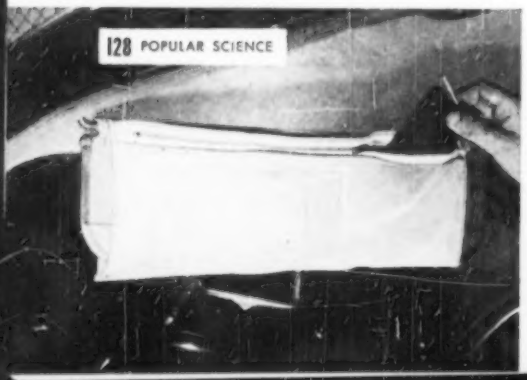
A STANDARD tractor turns into a construction machine when a bulldozer is added to one end and a scoop shovel to the other. The shovel can dig a ditch seven feet deep and 50 feet long in one hour. The 'dozer, which can be installed in 20 minutes, is controlled by one valve. Both implements, made by Shawnee Mfg. Co., Topeka, Kan., will fit Ford and Ferguson tractors.

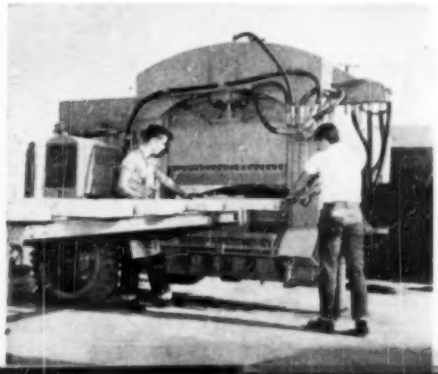
Driver's Carryall Slides on Sun Visor

HERE'S relief for that overcrowded glove compartment. It's a new plastic pouch, tailored to slip over any car's sun visor as shown below, that keeps your glasses, cigarettes, and other odd-and-ends within easy reach while driving. When the visor is up, the sleeve also makes a map holder, with a pencilled route clearly visible through the transparent plastic. The pouch, about 6 inches deep and 15 inches long, closes with a zipper fastener. Edward Steele, of Pittsburgh, sells it for $1.49.

Sharp Teeth Split Rock With Ease

Two rows of sharp teeth in the machine below put a 200,000-lb. bite on the toughest quarry rock, splitting it apart smoothly. A hydraulic equalizer brings the two jaws, each with 19 tool-steel teeth, 2½ inches wide, against the rough surfaces with equal force. Called the Guillotine, the machine weighs 5¾ tons, and can handle 100 tons of rock a day—sandstone, limestone, granite, or marble. Made by the Vesper Co., of Glendale, Calif., the machine is operated by a small gas engine or an electric motor.



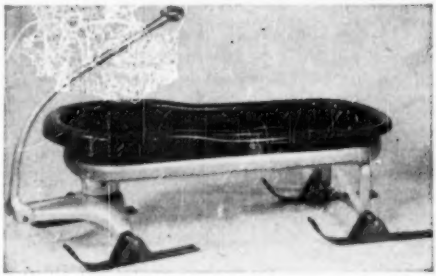


Thrill Ride Defies Gravity

THE floating card players above aren't magicians—their chairs and table are held in mid-air by the centrifugal force of a whirling drum. The giant drum (right), a new amusement-park thrill ride at Frankfurt, Germany, revolves at 15 m.p.h. At top speed, its floor suddenly drops down, leaving the riders pinned to the walls by a force double their own weight. Above the drum are six balconies from which spectators can look on.

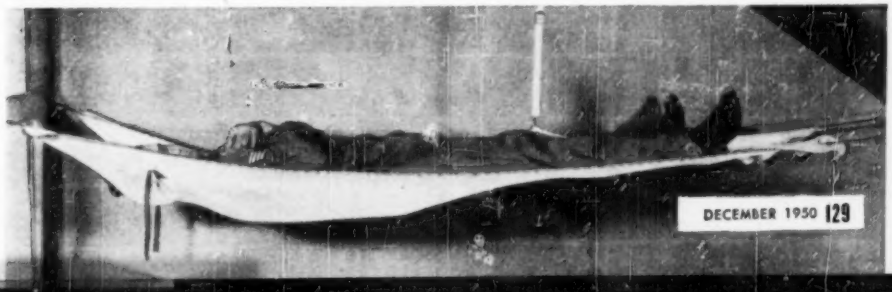
Runners Convert Wagon to Sled

JUNIOR can use his wagon all winter long with this set of runners that converts it quickly into a sled. Made of heavy-gauge steel, the red-enameled runners are attached to the wagon's axles in place of the wheels. They fit all ½-inch-diameter axles and are provided with bushings for use on ⅜-inch-diameter axles. Made by the Domestic and Import Sales Co., of Canyon, Texas, a set of four runners sells for $3.29.



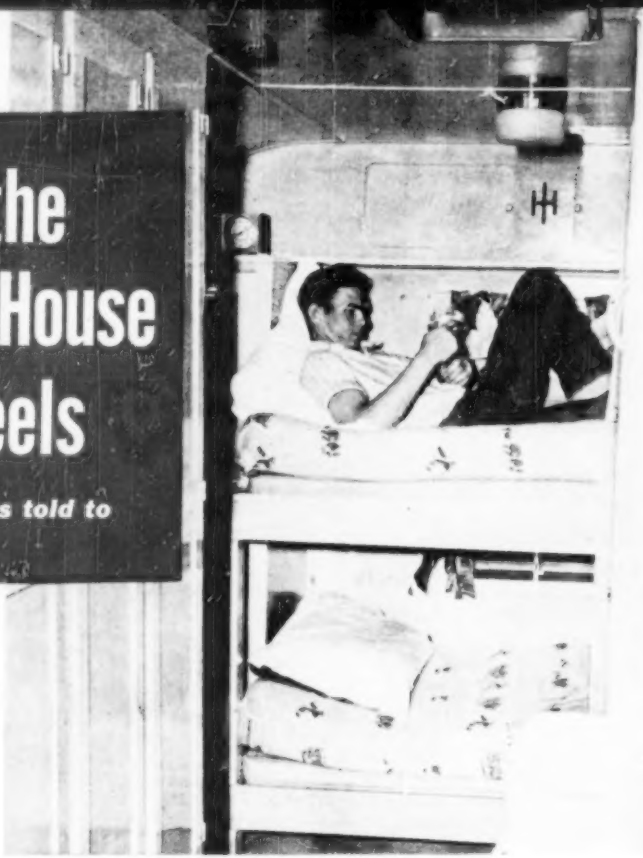
Nylon Hammocks Make Airborne Beds for B-36 Bomber Crews

STANDBY crew members on long-distance B-36 bomber missions can now take cat naps in this new nylon hammock right up in the forward compartment without making the tight-squeeze, pressurized-tunnel trip back to sleeping quarters in the stern. Made of nylon netting, the 78-inch hammock will support 600 pounds. Adjustable straps at head, neck, and knees let each man tailor the hammock to his own sleeping habits.



I Put the Boarding House On Wheels

By Marvin Dye as told to James Joseph



A boarder curls up in his top bunk with a good book. Each bunk has individual ventilation unit, window.

PS PHOTOS BY JAMES JOSEPH

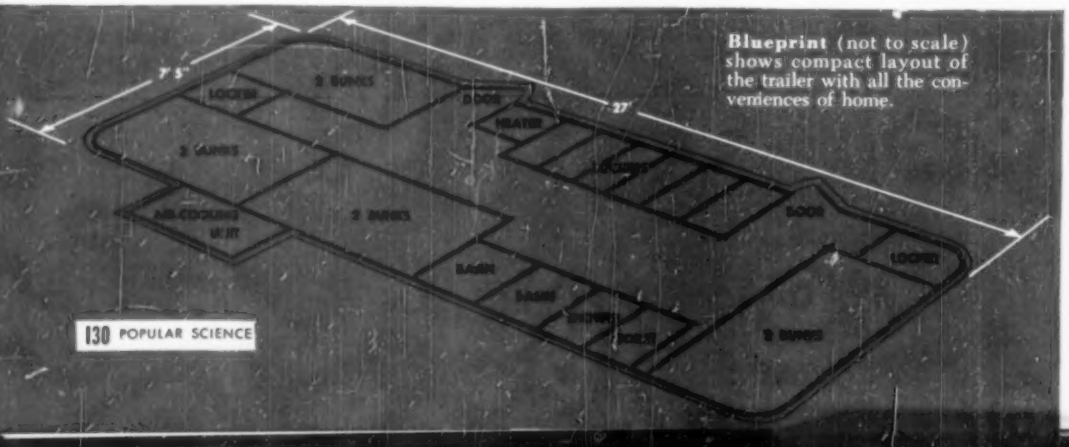
INVENT the wheel? Of course I didn't. Neither did I originate that forlorn institution, the boarding house. What I did was to combine the two—and at a profit.

It all began with a dirty towel and a two-by-four room I shared with another fellow, for the price of a night at the Ritz. Dirty towels and jumping from town to town are two of the occupational hazards of a pipeline welder like myself who follows construction jobs from Texas to California.

But somehow this particular dirty towel sent me into a rage, and out of it came a money-making idea.

We'd just pulled into our second town in a week—somewhere in New Mexico—and as usual room rates started climbing as we approached the city limits. My partner and I found the last remaining room in town, plunked down $20 apiece for the week, and climbed the foot-worn stairs to bed.

Hanging alongside the old-fashioned



Blueprint (not to scale) shows compact layout of the trailer with all the conveniences of home.

washbowl was a single towel—one towel and two guys to share it. I grabbed it, rushed downstairs, dangled it before our landlady's face, and demanded, "How come?"

"One towel to a room," she replied firmly, "that's all my other boarders get and you ain't no better."

Then and there I vowed that one day I'd have a mobile boarding house, on wheels. Something de luxe we could carry right with us. Something streamlined, ultramodern, and everybody would have his own personal towel, all the laundry and maid service he could ask—yes, and even breakfast in bed!

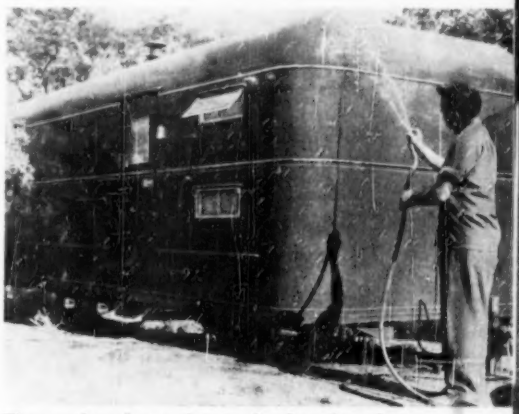
A few days later I stopped at a trailer dealer and asked some questions. When I emerged four hours later I had dollar signs before my eyes. Half of the dollar signs spelled out profits.

At first the dealer had scoffed at the idea of a roving boarding house. Finally he said I should draw up my plans, submit them to a trailer manufacturer in Chicago, and sit back and wait. I'd either get a horselaugh for a reply or one of the most luxurious stables on wheels.

Next, I visited a local banker who luckily was sympathetic toward trailers. He said he didn't see any reason why I couldn't get a loan, providing I could show a full house and a steady flow of rentals coming in.

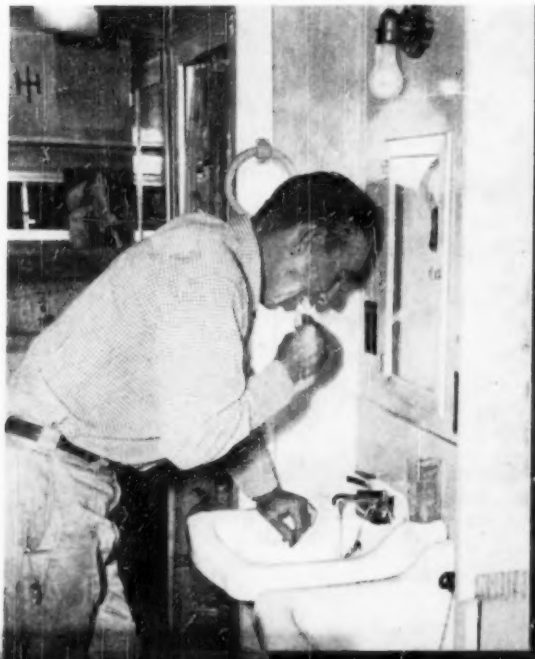
My boarders, I figured, would be guys working the pipe line. We'd all move together and so would our boarding house. But I could see my boarding house would work just as well in a permanent location—say in a trailer camp, or in some deer-filled woods. Or maybe overlooking one of those crystal-blue lakes where trout do fin-flops.

I wanted a compact, self-contained unit,



The author keeps his trailer boarding house sparkling with a daily washdown. Heavy-duty truck tires give better traction on the road and keep trailer from bogging down in the mud.

Two basins and a shower (with plenty of hot water) were planned so that all eight boarders could get ready for work within 45 minutes. Tooth-brusher below is on his last lap.



Built-in individual lockers have plenty of room for both work clothes and Sunday best. Each of the eight spacious lockers is 77 inches high, 21 inches deep, and 15 inches wide.

with everything—showers, bunks, lockers, toilet, washing facilities, heating, and air conditioning.

The dealer told me that a de luxe, custom-made trailer boarding house as I'd described it would cost from $4,000 to $5,000, depending on size and just how elaborate you got. I decided to keep the total cost down to $4,000 if possible. I'd have to sleep and feed enough boarders to pay the monthly installments—plus making a profit. Eight boarders at $16 to $25 a week would pay my bills and fatten my bank account.

Needed: Elbowroom and Kilowatts

Each boarder would need a bunk, individual locker, and there'd have to be enough room so guys wouldn't be falling over one another. There ought to be a window by every man's bunk, and good reading light. And outlets for electric razors and for a radio. Which meant a portable light plant.

What about chow?

The smart thing, I told myself, was to design a big trailer for sleeping and buy a smaller one for myself. I'd sleep in it, use it as an administrative office, and convert half into a combination kitchen and dining room.

When I mentioned my boarding house idea to a fellow worker, he said I was nuts. "One guy snores," he said, "and it'll sound like a foghorn in the East River tunnel."

So we'd have to have some soundproofing.

Then I hit upon a novel idea. Why not custom-build the mobile boarding house around the men who'd live in it? I began to collect data. I asked 10 men how much clothing and gear they had and converted their answers into cubic feet. I drew up a chart and found that the average height of guys on my crew was taller than the national average. I even discovered how long it takes one of our men to shave in the morning; how long to wash up after work; how many showers he takes a day.

What seemed a simple job at first became a matter of logistics. A statistician would have come in handy.

From my data, I discovered that eight men could live comfortably on 200 square feet of floor space. But how long and how wide should the boarding house be?

Many of the 48 states have their own ideas. Most states say 96 inches is maximum width for trailers on their highways. But Connecticut and Rhode Island allow up to 102 inches. A majority of states specify 35-foot over-all length as maximum. Again

The boarding-house reach is enacted in a smaller, 21-foot trailer that serves as a combination dining room, kitchen, and living quarters for the author. Everybody gets seconds.

there are exceptions: Connecticut allows them up to 45 feet; Minnesota, to 40 feet.

If you want to travel through all the states, you've got to comply with the minimums. Besides, if your mobile boarding house is going to poke around the backwoods, the narrower and shorter the better. So to get the required 200 square feet, and yet stay within the legal limits of all 48 states, I designed the trailer 89 inches wide and 27 feet long. That gave me about 202.5 square feet.

Having queued up outside many a boarding house washroom, I knew that it takes about 20 minutes to wash, brush your teeth, and shave—on the double. Statistically speaking, two wash basins and a shower would keep three men busy simultaneously and turn out all eight boarders, washed, shaved, and in their Sunday go-to-meeting clothes within 45 minutes.

Bunks were designed double-decker, with inner-spring mattresses. Eighty inches of trailer headroom would spare boarders' noggins, even the upper-bunk boys.

Hot Showers on the House

To the average boarder a hot shower is only a tantalizing trickle. My boarding house was going to have a Niagara of hot water.

A poll of three plumbers agreed that a 30-gallon tank, electrically heated, would give us all the hot water we could use.

I designed each of the eight lockers to contain approximately 14 cubic feet. That's enough for all a boarder's clothes, boots, and working gear, with enough space left over for a couple of bear traps if he's got the inclination. Six lockers face the wash basins for convenience; there's one at either end of the trailer by necessity.

A centrally located kerosene circulating heater, with two floor outlets to heat from the floor up, was planned.

Since most of our work is in dry, desert country, an evaporative-type cooler would give us all the air conditioning needed. I designed a louvered wall panel so that our cooler could be set up outside the trailer, blowing in cool, fresh air.

Our inside toilet would have to work anywhere. An automatic pressure flusher draining through a two-inch hose seemed to be the answer. In a trailer court, it would empty into a cesspool; elsewhere, we could dig a deep hole for drainage.

Some technical details I decided to leave up to the manufacturer. I specified extra-heavy channel iron for the frame, six-inch stuff instead of the usual four-inch. From two to four inches of spun glass and rock wool insulation between the trailer walls was another specification.

What's a home without a woman's touch—even in a trailer? So, a local girl is hired part time at each stopover to cook meals, do the laundry, and keep things spick-and-span.

I sketched in my rough floor plans and mailed them, along with a statement that the bank would finance my venture, to the Chicago manufacturer. Instead of the horse-laugh, back came the most de luxe mobile boarding house roaming American highways.

My boarders can have breakfast in bed if they want. Laundry goes out twice a week. I've even tucked in bed some of our younger boarders until the guys started calling me "Momecita"—border Spanish for "little mother."

My mobile boarding house is all but paid for now. I've got a steady income. I can see mobile boarding houses springing up all over the country—for sportsmen, touring parties, exploration groups. You won't get rich, but you'll make a decent income and live in luxury. END

W. E. Burnett, assistant Ford car engineer, shows PS's Wilbur Shaw radiator-grille styling changes in 1951 Custom Deluxe sedan.

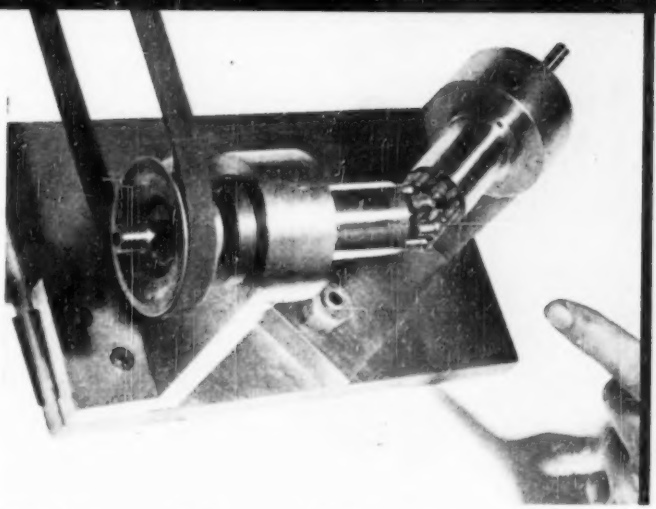
'51 Ford Holds Same Lines, Has New Radiator Grille

WHILE Ford for '51 has retained the lines introduced in mid-1948, many small styling changes are evident. The most obvious of them is the twin radiator-grille ornament.

Adding to the smoothness of operation made possible by the introduction of an automatic drive (see page 94) is a reduction of the backward tilt of the engine from 6° to 4°. The engine mounts also have been redesigned to reduce the transfer of engine roll to the chassis of the car.

Rear view of new Ford shows three-lens tail lights and extension treatment of rear fenders. Front seat rides on curved rails in fore-and-aft adjustment, tilting forward for short drivers.

Important dashboard controls are at left so kids alongside the driver can't monkey with them. Turning ignition key just beyond "on" position actuates engine-starting motor.



High-Speed Universal Joint Runs at Sharp Angles

ERNEST A. STARBUCK, 81-year-old Peoria, Ill., machinist, was troubled by the limitations of universal joints. Ordinary ones have parts that operate at varying speeds, setting up wrecking vibrations that limit their use to small angles, low speeds. And the fancy, constant-velocity types are costly.

So Starbuck devised the joint shown above. It consists of two shafts connected by rods fitted into holes in each end. The rods have ball-and-socket joints in the middle that let them bend at a desired angle. When the driving shaft rotates, the rods act as cranks, turning the driven shaft.

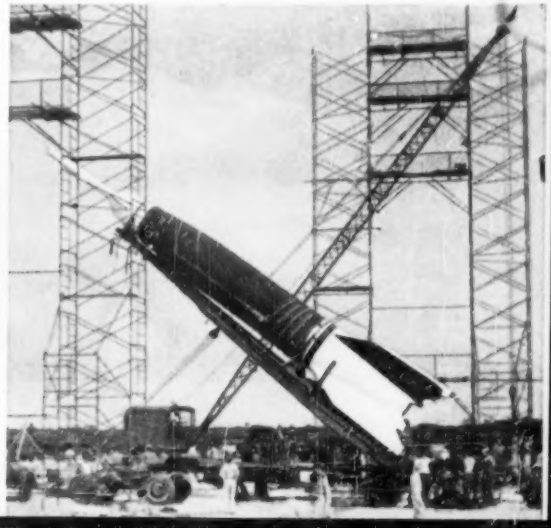
The new constant-velocity joint, which its inventor believes can be made for the same cost as ordinary joints, has operated at angles up to 95° and speeds up to 10,000 r.p.m. It can also be used as a fixed-angle drive, eliminating bulky bevel gears.

French Loco Hits 100 M.P.H.

THIS fast new electric locomotive will soon be speeding passengers and freight over French railways. Hitting up to 100 m.p.h., it made a 146-mile test run from Paris to Tours in two hours and eight minutes—half an hour less than the scheduled time. Weighing 102 tons, the CC7001 is 40 tons lighter than older models. Flexible trucks, incorporating 12 driving wheels, are said to improve stability at high speeds.

German Cart Totes Big Rocket

THE strange-looking rocket cart below, captured from the Germans during World War II, is now helping U. S. rocket experts. Called a Meilerwagon, the wheeled cradle, towed by a truck, carries a rocket to the firing site, then tilts up, raising the rocket to a vertical position on the launching platform. Here the cart readies a two-stage "Bumper" rocket at the Long Range Proving Ground, Cape Canaveral, Florida.



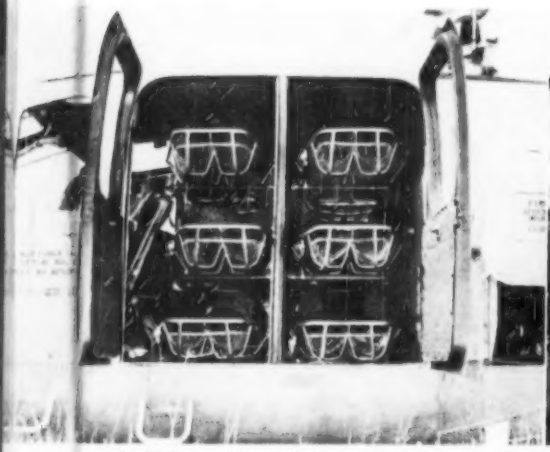
'Copter Ferry Hops To the Front

A NEW version of a two-bladed helicopter (PS, Feb. '48, p. 165), designed for the U. S. Air Force, can be used as a small troop carrier, ambulance plane, or ammunition ship.

The largest helicopter built by the Bell Aircraft Corp. of Buffalo, it is known as the H-12. It is powered by a Pratt & Whitney 600-hp. engine. The rotor teeter-totters on its hub as it revolves to equalize its lift.

Advantages of the helicopter in evacuating wounded include the ease and speed of landing and take-off, reducing ground time to minutes. 'Copters also can land in areas too small for regular airplanes to use. Hospitals need not be built near specially constructed airstrips.

Doors of the H-12 are 50 by 49 inches. The compartment is 4 feet high, 7 feet wide, and 3½ deep. Aft is extra cargo space.



A half-dozen litters for wounded men can be stowed in the capacious interior of new 'copter. Machine weighs about 3½ tons, has a cruising speed of 85 m.p.h., top speed of 120.

Close-up of cabin shows eight infantrymen with full equipment, plus pilot. Soldiers can disembark in four seconds. Troops are members of 174th Infantry, New York National Guard.

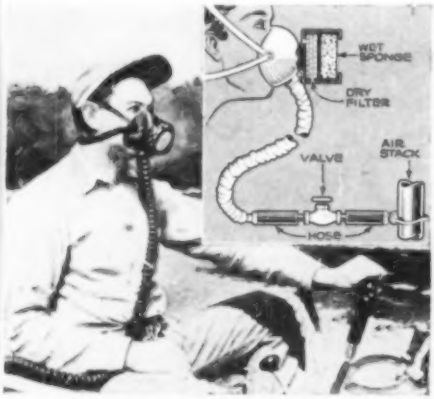
Helicopter's many jobs in wartime would include movement of squad-sized units to combat areas in emergency operations. Without heavy equipment, 10 passengers can ride in the H-12.

Like an enormous, four-legged bug, H-12 hovers preparatory to landing. Normal fuel capacity gives it a range of 500 miles. Aircraft can hedge-hop to avoid enemy fire.

Hatch in fuselage belly eases problem of rescue from ground or sea where landings are impossible. Here a soldier is being pulled upward through hatch by engine-powered hoist.

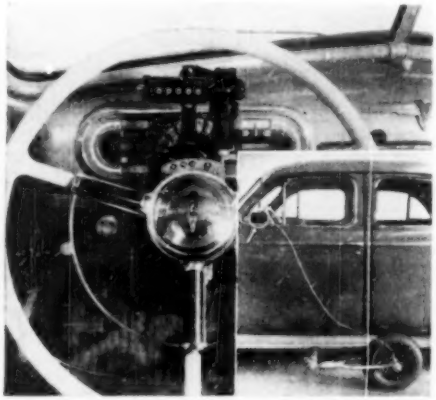
GIs Get Better Front-Line Radio Communications

THE handie-talkie of World War II has been redesigned (left above) to give improved reception in a frequency-modulated unit that ties in with other Army FM communications. This battery-operated receiver-transmitter has a range of one mile. At right is a new version of the walkie-talkie. Only half as heavy and bulky as earlier sets, it has a range up to five miles. The new equipment was developed to help knit infantry, armor, artillery, and supporting troops into a coordinated team.



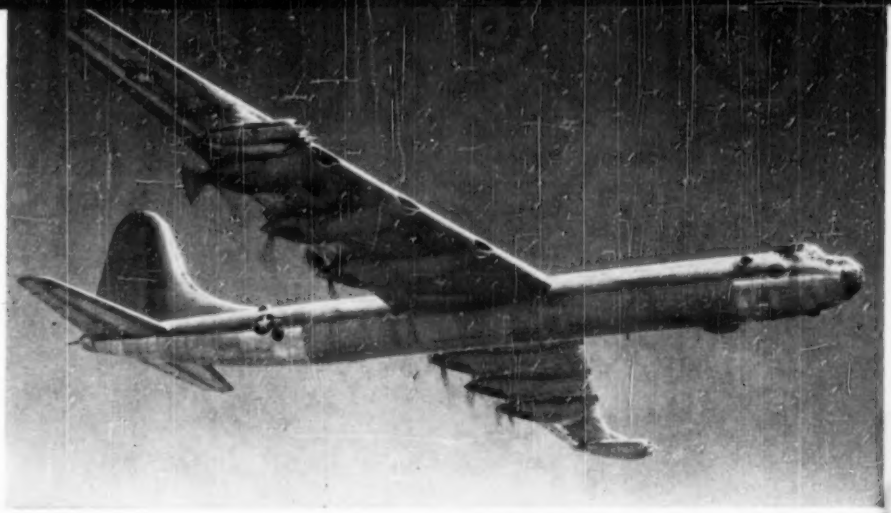
Dust Mask Cleans and Cools Air

DRIVING a tractor through a dusty field on a hot day is made pleasanter by this dust mask. The inventor, N. E. Gaddini, of Winters, Calif., claims it conditions the air that the operator breathes. The Filtercool mask is connected by a length of garden hose to the engine air intake—the vacuum creating a positive and constant air flow. Air entering the mask is evaporation-cooled by passing through a wet sponge, then cleaned by felt and cotton filters. Stale air is withdrawn by the vacuum.



Extra Wheel Measures Road Distances

AN INSTRUMENT that quickly and accurately measures road distances from a moving car or truck, but which operates independently from the car's wheels or speedometer, is now in use by the Minnesota State Highway Department. A 4.00 x 8 pneumatic tire and wheel (inset) is attached to the undercarriage by a telescoping tube. As it turns, distances are registered in feet on a recording head mounted on the steering column and driven by a flexible cable from a drive joint on the extra wheel assembly.



Superbomber Cruises 8 Miles Up

THE B-36 above is shown in one of the first photos ever taken of the giant intercontinental bomber flying close to its top ceiling, which is above 45,000 feet. At high altitude its four auxiliary J-47 jet engines, seen in twin pods slung below the outer wing panels, are at their peak efficiency to give the bomber an added boost of speed after dropping its bombs over an enemy target. This jet power, added to the six 3,500-hp. pusher engines, gives the Convair B-36 a total of more than 40,000 horsepower for take-off, climb to altitude, and speed bursts in emergency.

Swirling Spray Quenches Pier Fires

THE New York City fireman at right is holding a new Quayle nozzle designed specially to fight fires underneath piers. Shown in action above, the nozzle throws swirling sprays sideways instead of directing a steady stream ahead. In operation, the nozzle is inserted through access holes in the pier floor. When pressure is turned on, the horizontal curtain of water flares out to battle hard-to-get-at substructure flames.

New Toys: A Christmas Preview

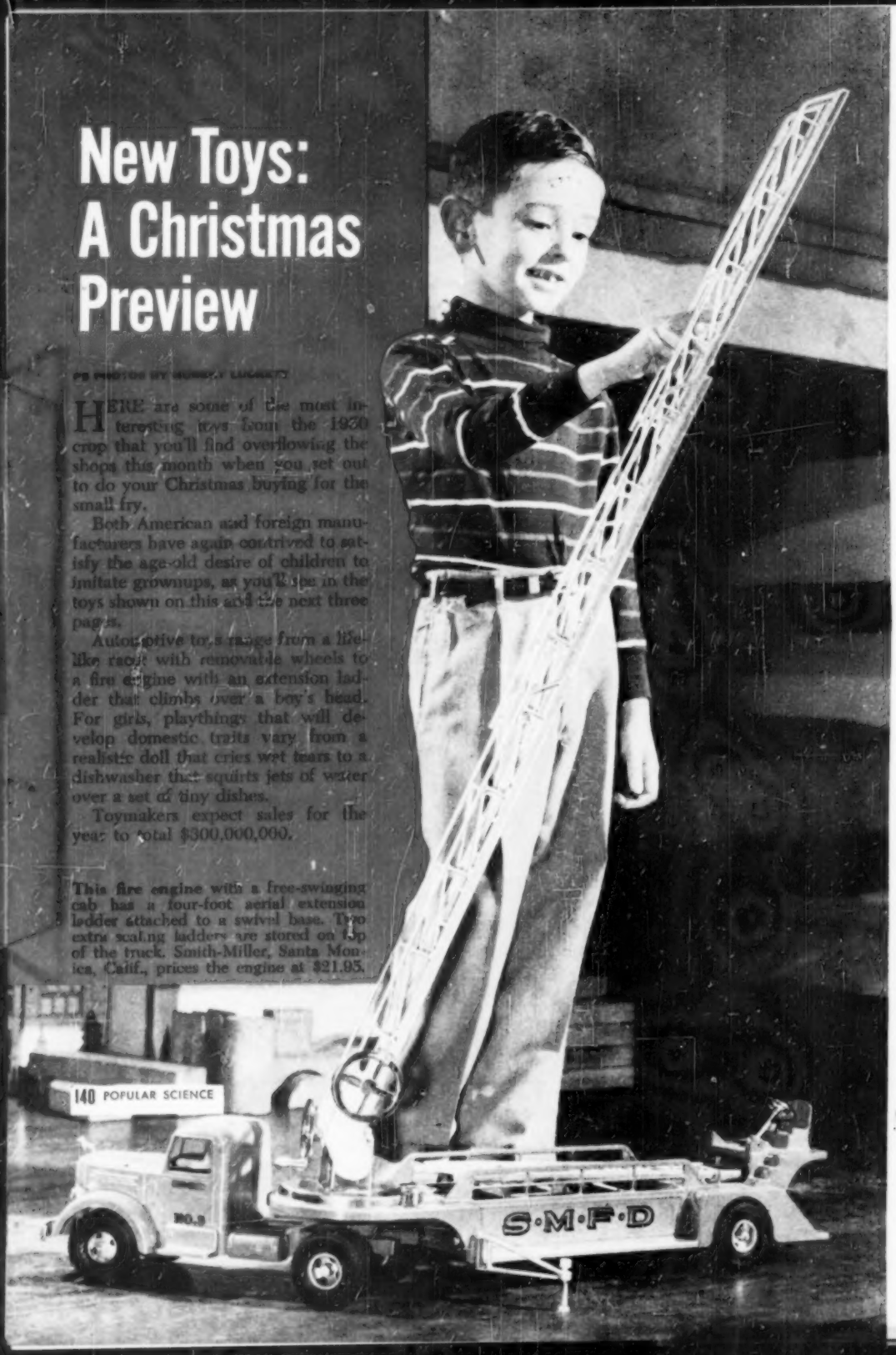
PS PHOTOS BY HUMPHREY LUCAS

HERE are some of the most interesting toys from the 1950 crop that you'll find overflowing the shops this month when you set out to do your Christmas buying for the small fry.

Both American and foreign manufacturers have again contrived to satisfy the age-old desire of children to imitate grownups, as you'll see in the toys shown on this and the next three pages.

Automotive toys range from a lifelike racer with removable wheels to a fire engine with an extension ladder that climbs over a boy's head. For girls, playthings that will develop domestic traits vary from a realistic doll that cries wet tears to a dishwasher that squirts jets of water over a set of tiny dishes.

Toymakers expect sales for the year to total $300,000,000.

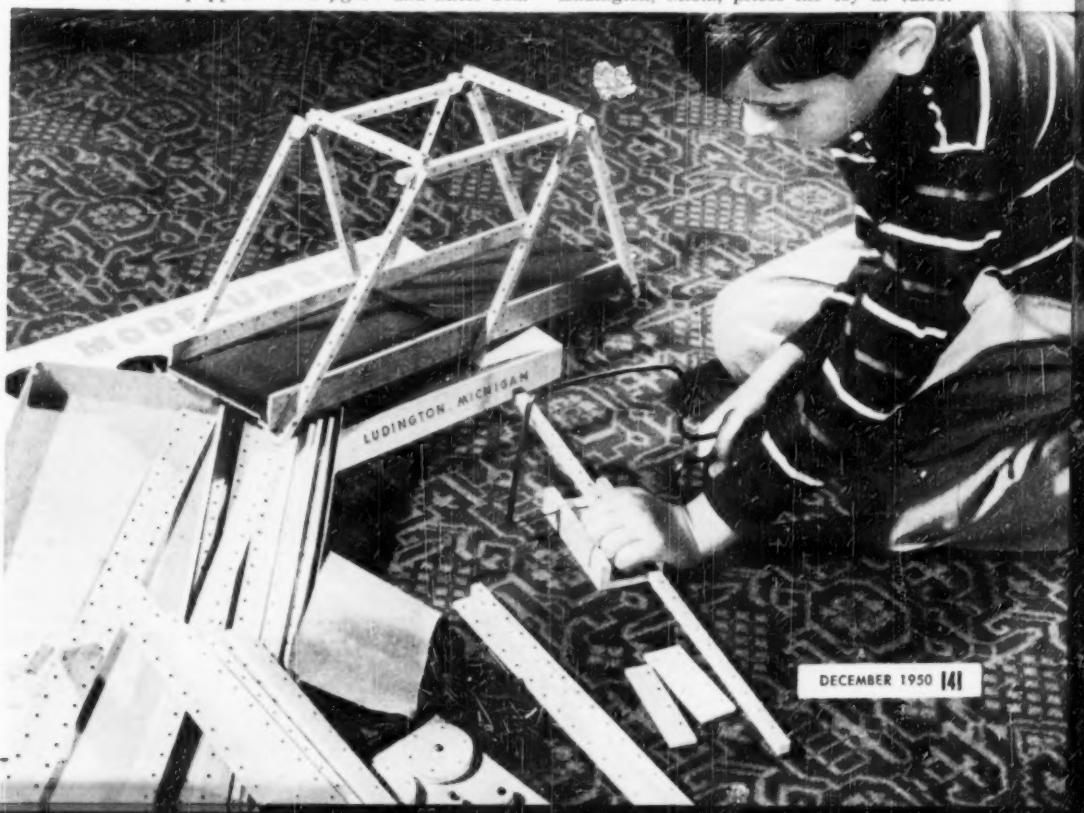


This fire engine with a free-swinging cab has a four-foot aerial extension ladder attached to a swivel base. Two extra scaling ladders are stored on top of the truck. Smith-Miller, Santa Monica, Calif., prices the engine at $21.95.

Called Dizzy Doodler, this toy lets a child "draw" a design on a pad by turning the handle of the machine. A system of adjustable bars and pulleys activates a tricolored drawing head that can make hundreds of symmetrical designs. Carter Craft, Dallas, sells it for $4.

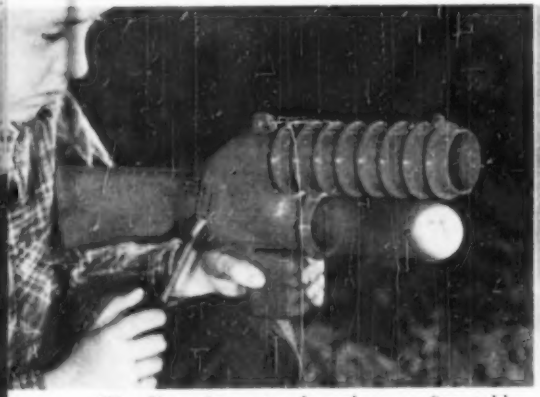
The miniature electric reed organ above has a range of two full octaves. Plugged into an outlet, a 1/60th-hp. motor powers a blower fan that supplies air for making music on the instrument. It is made of plastic by Magnus Harmonica Co., Newark, N. J. Price, $18.75.

Junior cuts hardwood strips to the length he wants with a lumber construction set (below) that is equipped with a jigsaw and miter box. The kit also includes wheels, sandpaper, and nuts and bolts. Carrom Industries, Inc., of Ludington, Mich., prices the toy at $2.95.



Besides drinking from a bottle, blowing a bubble pipe, and wetting her diaper, this doll cries watery tears, as shown above. Tiny Tears can be given a bath, and has a suitcase to hold accessories. The toy, made by American Character Doll Co., New York City, costs about $12.

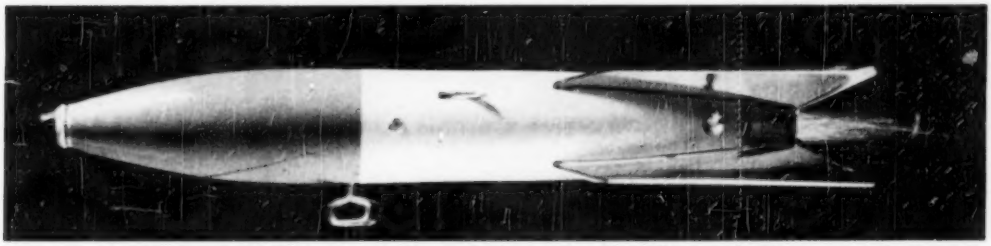
Made in Germany, the Schuco racer has removable wheels and tires. A tool kit is displayed in foreground above. The car's motor is wound by turning a hand crank or by pressing a friction wheel on its underside. It has steerable front wheels and a differential gear. Price, $4.



The Kazooka, a toy bazooka gun, fires table-tennis balls. Six balls are loaded into the upper muzzle. Each time the gun's crank is turned, a spring is tripped, propelling one of the balls out the lower muzzle. Kusan, Inc., of Nashville, Tenn., prices the gun at about $2.98.

A scale model of a real street sweeper, the windup toy above has rotating brooms that brush the surface it runs on. Two of these are located at the sides of the machine, one at the back. The rear wheel is steerable. Ny-Lint Tool & Mfg. Co., Rockford, Ill., sells it for $2.98.

The truck above is the miniature counterpart of a full-size one that dumps dirt loads from the bottom. Its trailer unhitches from a coupling post to allow the tractor to tow other toys made by Doepke, of Rossmoyne, Ohio. Priced at $12.95, the truck has steerable front wheels.



Screaming shrilly, this windup 'Tomic Rocket streaks across the floor on wheels, shooting sparks from its exhaust. Made by Print-O-Matic Co., Inc., Chicago, the shatterproof plastic rocket, top view shown, sells for $2.98. A cigarette-lighter flint creates the sparks.

This garden barrow comes from Germany. Its carrying tray has a sifter for separating stones from a load of dirt. The tank mounted in front of the toy's body holds water that pours from a spigot, as shown above. F. A. O. Schwarz, New York City, prices the barrow at $15.

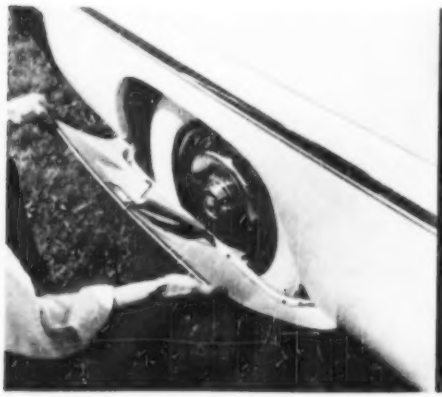
The dishwasher above is a miniature in exact scale of a Youngstown machine. It really works when a hose is hitched to a faucet. Water pressure spins a tube with holes, throwing jets of water on plastic dishes. Mullins Mfg. Co., Warren, Ohio, sells it for about $13.

Slicked-Up Mercury Looks Longer

Stopped on 30-percent grade, new Mercury with automatic drive starts moving easily in low.

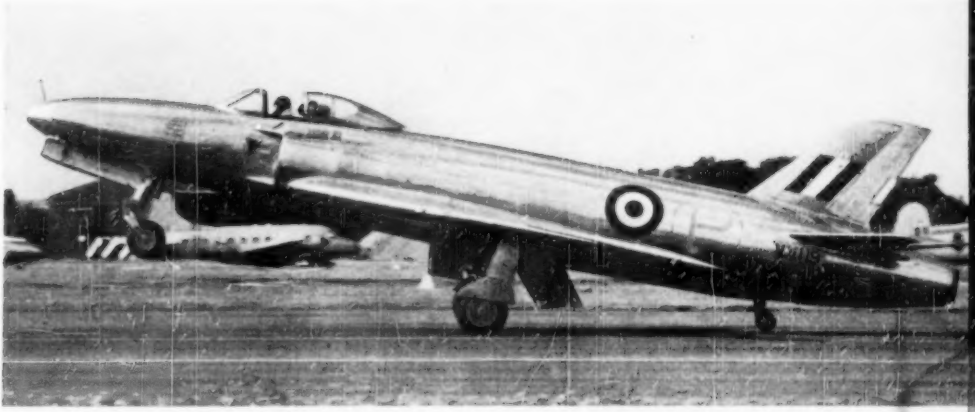
THE most important change in the Mercury for 1951 is the addition of an automatic transmission (see page 94) that eases traffic driving and simplifies the job of starting on hills. With no clutch, you just throw the selector lever into "Drive" and release the brake as you step on the gas.

Sedans and coupes have a third more rear-window space. The familiar lines of this year's models have been dressed up a bit.



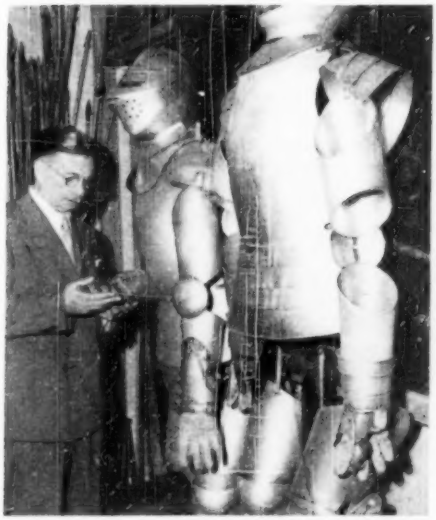
Snap-on fender shield is an accessory for '51. Standard manual-shift transmission has a new "balanced tooth" design. Teeth with coarser pitch are expected to double gear life.

High rear-fender extension makes car look longer and adds to lowness of silhouette. Adapted to Ford Motor Co.'s middle-priced car, new transmission is called Merc-o-Matic.



British Jet Fighter Has More Sweepback, Extra Wheel

POISED for take-off, Britain's newest jet fighter, the Vickers Supermarine 535, prepares for a recent demonstration flight at Farnborough, England. Powered by a Nene jet of 5,000 pounds thrust, the slim, cigar-shaped fighter is said to be one of the fastest planes in the world. Its sleek wings incorporate more sweepback than any previous British fighter. It sports four 20-mm. cannon and a tail wheel in addition to a nose wheel.

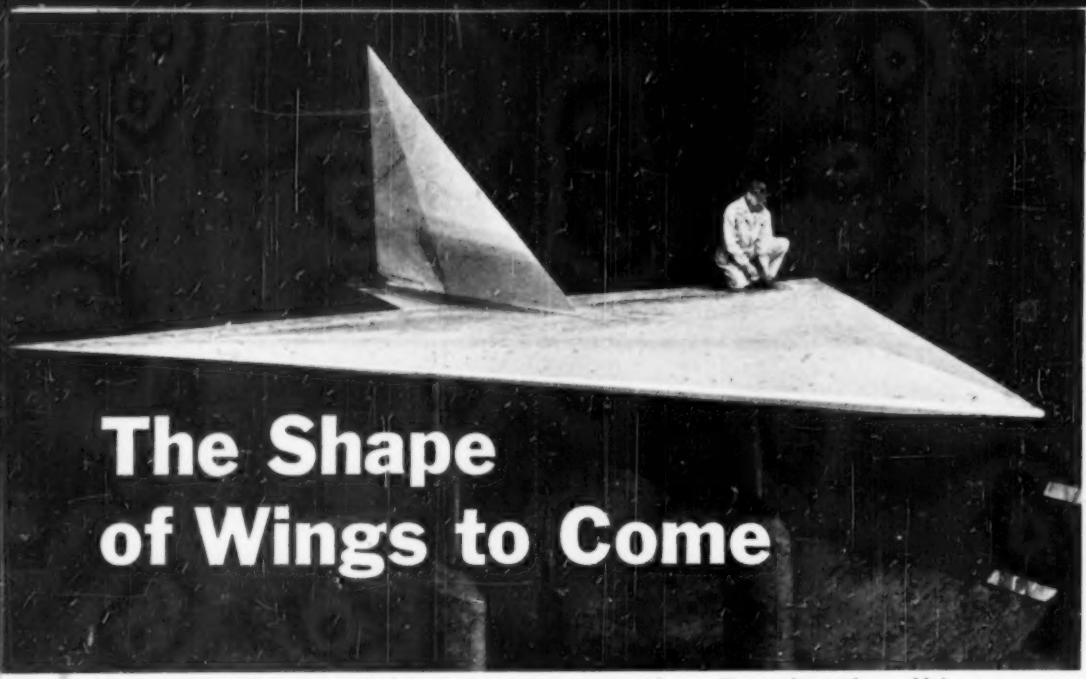


Aluminum Armor Lightens Actors

THE next time you see your favorite movie actor in shining armor, he may be wearing shining aluminum. The Western Costume Co., of Los Angeles, Calif., rents out these special suits of lightweight armor, made of aircraft sheet aluminum, to motion picture studios to save actors from having to wear the heavy, cumbersome, authentic armor.

Britain Gets New Super-Tank

MOUNTING the heaviest gun ever put into British armor, a 20-pounder, this new 50-ton super-tank weighs 2½ tons more than the U. S. Army's General Patton (PS, Nov. '50, p. 117). Believed to be the first new tank to go into mass production since World War II, the Centurion will become the standard tank of the Royal Armoured Corps. It is powered by a Meteor aircraft engine. Side plates protect it against antitank grenades.



The Shape of Wings to Come

Three-cornered wing is readied for tryout in Moffett Field wind tunnel. Studies indicate that this bizarre shape, perhaps with flaps added at edges, has great promise for tomorrow's interceptor planes. Triangular craft would have enormous top speed. How it behaves at lower speeds, as in landing, will determine its future as a practical warplane.

Radical new designs being tested in the world's biggest wind tunnel give a preview of tomorrow's planes and missiles.

By Andrew R. Boone

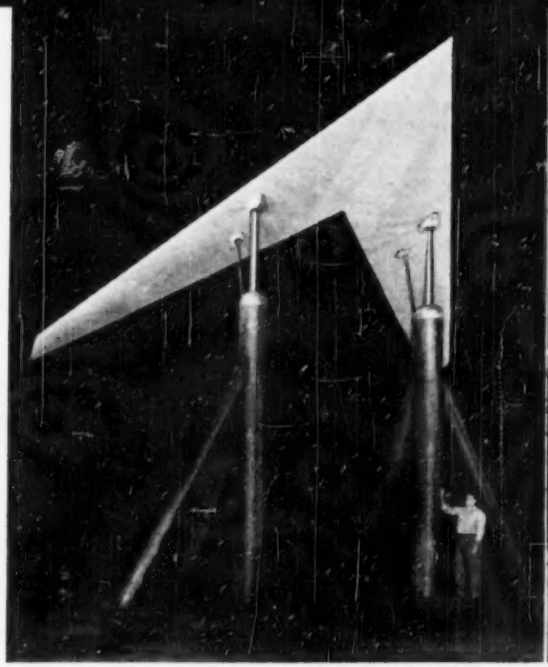
IS IT a bird? A plane? An umbrella? A supersonic craft of the future, streaking through the skies, may resemble nothing you've ever seen before. An interceptor plane, some experts foresee, may be a flying triangle. And it may look like a three-cornered umbrella as it glides to earth, with flaps down on all three edges.

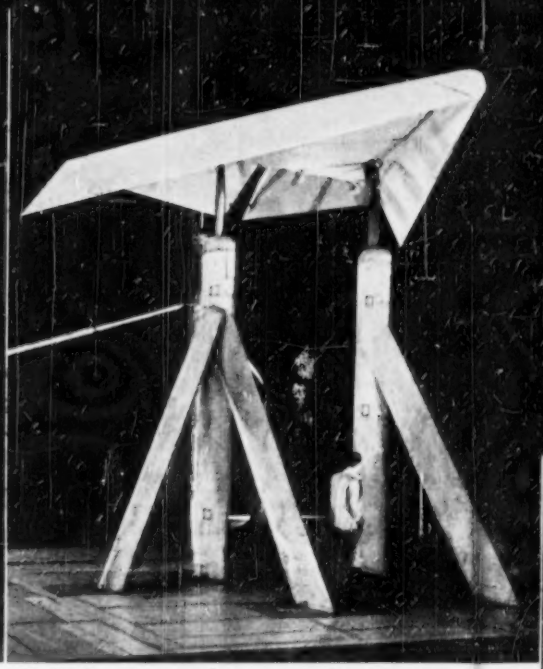
Wings for these planes and missiles of tomorrow are already taking shape in the world's biggest wind tunnel, the mammoth 40-by-80-foot test chamber of the NACA's Ames Aeronautical Laboratory at Moffett Field, Calif. Under test there are full-scale models that look as if their designers had thrown the rule books out the window. Some of the fantastic shapes may be the prototypes of planes to come. Others may never fly. But all are adding to the growing store of knowledge on the behavior of wing forms at speeds faster than sound.

Swept-back wings fly faster than straight ones. But as they lift about half as much, current swept-wing planes must come in hotter and land on runways twice as long. To permit safer landings, the scientists are trying out tricks to improve lift.

For example, tests show that building camber or curvature into a swept-back wing gives added lift—but not over the entire surface. Curving the wing, and twisting it too, successfully spreads the effect to the roots. But making this wing strong enough would be difficult. Could a similar result be obtained more simply? Desirable effects of camber and twist have been found combined in a triangular wing, with full-span flaps hinged to the leading edges, and a split-type flap at the rear. Odd as it looks, the droopy triangle has the desired ability to land at reasonable speed.

Lift at all speeds would be improved if the tendency of flowing air to pull away from the surface of thin, highly swept wings could be overcome. A wind-tunnel answer is a sucking device to pull air actually inside the wing through a porous leading edge (felt-backed screening was used in the trials). Experimentally, two electric motors powering a supercharger turn the trick.

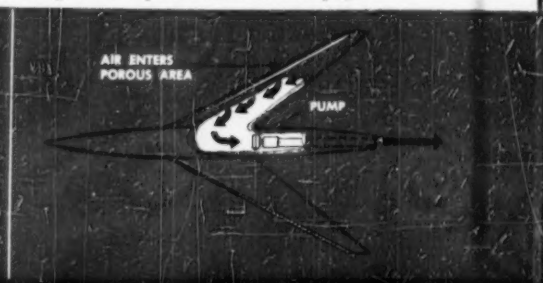




Flying Vee is one of odd experimental designs employing extra-thin, highly swept-back wings. Fill in the notch and add a vertical tail, and you have the triangular wing on opposite page.

Umbrella wing is droopy triangle. Flaps at all three edges give combined effect of wing curve and twist, a trick found effective for making a safe landing at a reasonable speed.

Another trick coaxes back air that tends to separate from surface of thin wing traveling at high speed. Layer of air immediately adjacent to skin is sucked inside wing through porous area on leading edge. This delays onset of flow separation, as shown in diagrams at left below. Other diagram shows application of method to design in the photo at bottom of page.



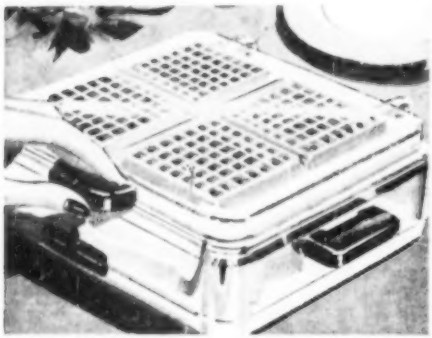
I'd like to see them make . . .

Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.

Paint cans with bowl-shaped covers. Such a can would afford ample room for stirring with no danger of paint overflowing the sides. The cover would serve as a color-mixing container. —*Michael Venezia, Jr., Floral Park, N. Y.*

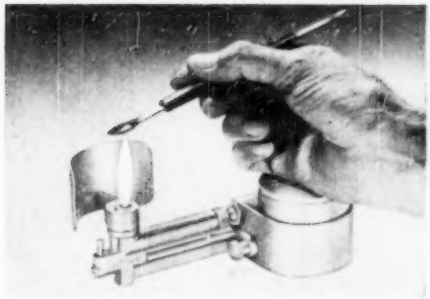
Magnetic steel tapes for measuring steel or iron pipe for cutting. They would be invaluable for plumbers and steamfitters, making it easy for one man to take measurements.—*William Barschow, East Liverpool, Ohio.*

Removable bumper guards of hard, tough rubber. Snapped onto the vertical braces of the bumper, they would make it possible to push a stalled car (or be pushed) without marring bumpers.—*William W. Love, Albemarle, N. C.*



Waffle irons with tops of transparent, conductive glass. Expectant diners would enjoy watching the waffles bake and the "chef" could tell at a glance when each batch was done.—*Duane Hallan, Hettinger, N. D.*

Suction cups on shoe-polish cans to hold them firmly to the floor or shoeshining box when in use. This would eliminate the need to put down the shoe each time to apply more polish to the cloth.—*D. Merry, Hillsboro, Ill.*



Burner Turns Itself On and Off

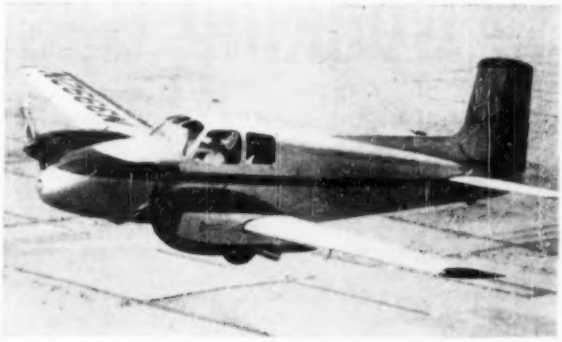
TOUCH the platform of this laboratory burner and the flame shoots up full (above). Take your hand away and it goes off, leaving only a small pilot light. The Touch-O-Matic burner, made by Hanau Engineering Co., of Buffalo, N. Y., can also be locked in the "on" position by turning the platform.

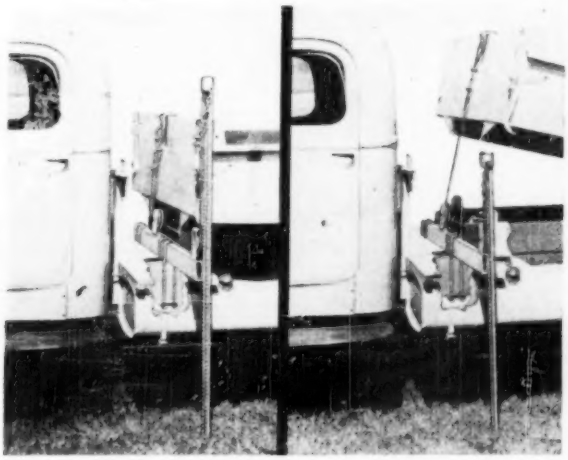
Airplane Towbar Has "Landing Gear"

EVEN the towbar for a B-47 jet bomber has landing gear. The 29-foot-long bar, partly supported by its own small wheels (above), simplifies ground handling of the big Air Force plane. Boeing engineers designed it to be broken into segments and carried inside the airplane.

Beech Bonanza Gets A Twin-Engine Brother

THE Twin-Bonanza, a six-place, low-wing monoplane for business and military use, will be rolling off the production line this spring. Newest in the Beechcraft family of medium-size planes, it cruises at 191 m.p.h. and lands at 59 m.p.h. on two 260-hp. Lycoming engines. Cabin structure and weight distribution are especially designed for safety.





Dump-Truck Attachment Drives Fence Posts

THE hydraulic lift of an ordinary dump truck drives fence posts when this attachment is added to the truck. The Nelson Post Driver consists of a steel cable, a set of pulleys, and a steel cap that fits over the post. As the dump body rises, the cap pulls the post down into the ground. The cutaway sections of the pictures at left show how the pulleys work. Rosenwald-Cooper, Inc., of St. Paul, Minn., the manufacturer, reports the device can set 100 snow-fence or farm-fence posts in an hour.

Fill 'er Up with Cooking Gas

Petroleum's unwanted stepchild—one of the world's finest fuels for internal combustion engines—is just now winning jobs in buses, trucks, and tractors.

By Devon Francis

ON THE Texas Gulf Coast there are some men who would give a fortune to anyone who could tell them how to get rid of a lot of high-octane motor fuel. There, and in California, Kansas, Oklahoma, and Louisiana, there are at least 450,000,000,000 gallons of the stuff in the ground. And much of that taken out goes begging.

Now a start is being made on using this fuel—the oil industry's unwanted stepchild, *liquefied petroleum gas*—as a substitute for gasoline to conserve the nation's oil reserves. If war should come, with a considerable diversion of gasoline to military use, LPG—as it is known—could be a godsend to the trucking industry and its 7,700,000 vehicles. Someday you may even be using it in your own car.

For LPG is one of the world's finest fuels for internal combustion engines. It won't ping. It burns almost completely. Its residue comes out of the exhaust pipe practically odorless. It won't form carbon. It's a guarantee against almost all crankcase oil dilution. And it's cheap.

But few people want it. They don't want it because there's a catch—the motor vehicle using it has to tote around a heavy tank to carry it and must have a special fuel system.

"Bottle gas," as LPG is known to the consumer, is used for cooking on tens of thousands of American farms. It's bottle gas that is used in Pullman air-conditioning systems. It was bottle gas that powered the engines of Germany's Graf Zeppelin before the war. LPG, in fact, has been used freely as an engine fuel in farm vehicles and trucks for many years in the U. S.

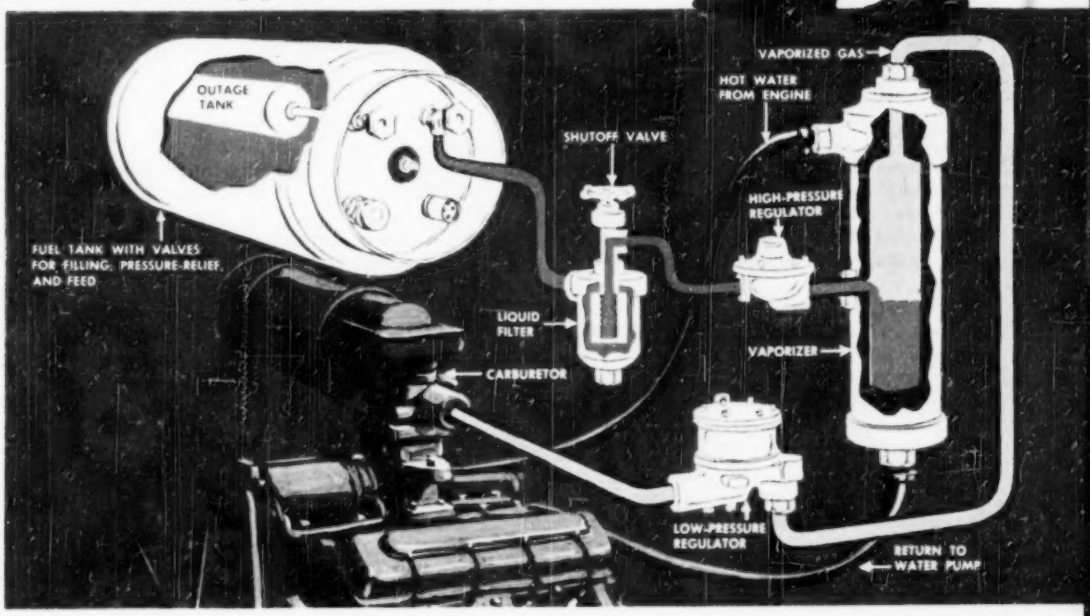
LPG = Butane + Propane

LPG's chief ingredients are two separate gases, propane and butane. Butane is the stuff that's added to your gasoline at the refinery each winter to make your motor start easier. It's butane that's burned in those new-fangled cigarette lighters that require a filling only once a month.

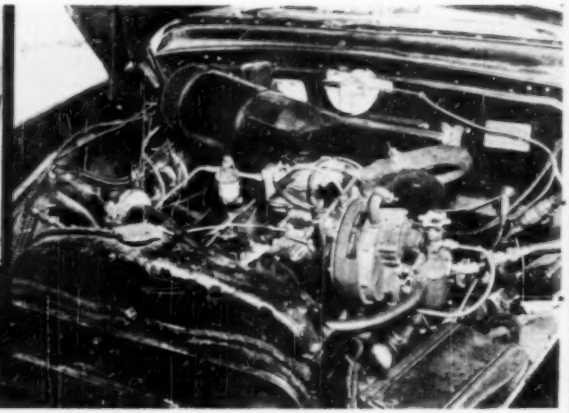
Neither propane nor butane is easy to

Two heavy 18-gallon tanks hold propane fuel under pressure in Phillips Petroleum Co. test car. Engine now has 10:1 compression ratio, will be tested at 12:1.

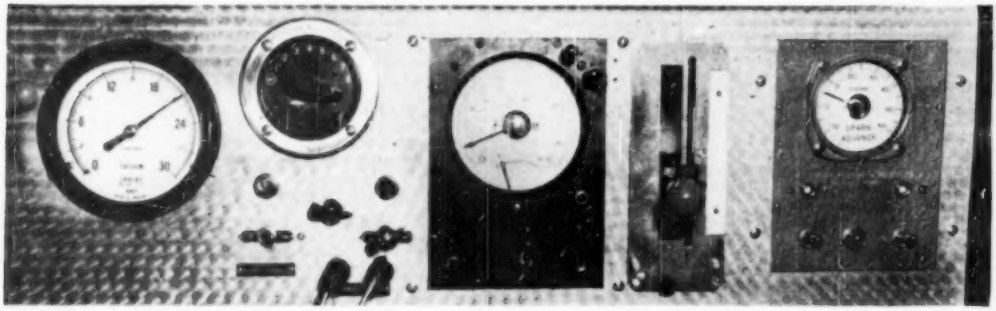
Diagram shows path of liquid propane as it flows from fuel tank, becoming gaseous for air mix in special carburetor.



PS reporter Devon Francis tries unsuccessfully to detect pinging in propane-fueled test car. Earphones amplify signals from detonation pickup on **high-compression** engine.



Maze of additional equipment and piping is required under hood of engine converted to the fuel. Propane-fueled vehicles have safety valve closing tank if engine stops or a line breaks.



Instruments on dash of Phillips test car report engine speed and temperature, manifold pressure. Lever at right controls the spark adjustment. Wires at bottom are for the knock meter.

handle. They're as volatile as a redheaded Irishman and have to be kept under pressure to make them stay in liquid form.

Of the two gases, easily separated from each other at the refinery, propane is becoming more and more a specialized motor fuel.

The biggest convert to propane in recent months was the City of Chicago which ordered 500 propane-propelled buses. But even if every bus in the United States started burning propane tomorrow, they wouldn't use a sixteenth of the country's annual capacity.

Propane is a "distress" fuel, as they say in the oil business. Most of it comes from natural gas. LPG has to be taken out before the gas is piped cross-country from the wells. Otherwise it condenses at pipe-line pressures and fouls the mains. As more and more natural gas is taken from the ground to meet a fatter demand, the propane taken out collects like newspapers in an attic.

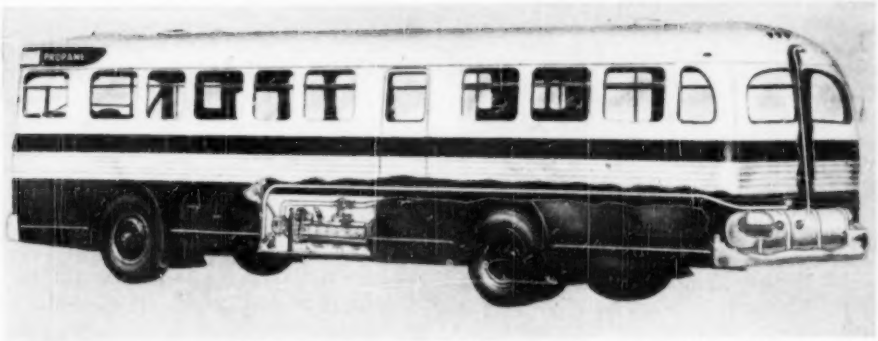
LPG is, like petroleum and the products associated with it, a hydrocarbon—it consists of hydrogen and carbon atoms. LPG contains about 60 percent propane, 40 percent butane, and a negligible amount of isobutane. This is the way a chemist describes propane:

```
    H H H
H–C–C–C–H
    H H H
```

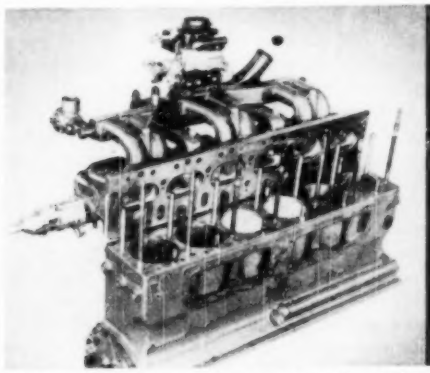
And this is butane:

```
    H H H H
H–C–C–C–C–H
    H H H H
```

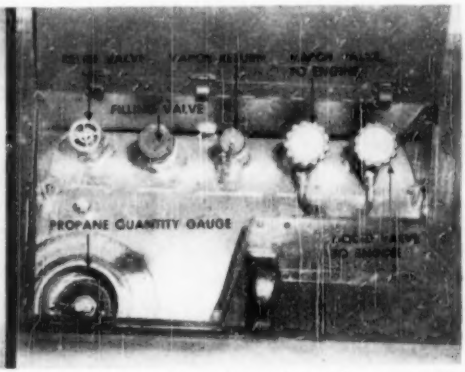
Propane has a much lower boiling point—almost down to −44° F—than butane. Released from the pressure that keeps it liquid,



Cutaway shows propane fuel system in new Twin Coach buses. Slow-speed engine produces 195 hp. at 1,400 r.p.m. It has 451 cu. in. displacement, a stroke of 5 in., bore of 4⅝ in.



High-compression engine for Twin Coach has patented oval-shaped combustion chamber to relieve bearings and crankshaft of some of extra-high pressures generated by burning gas.



Propane fuel tank has safety valves, controls. In refilling, nozzle automatically closes "outage" tank inside main tank, thereby providing expansion space for gas in hot weather.

butane will absorb heat so fast that it will freeze water. But propane will freeze mercury. Propane has more oomph when put in a motor. When you get above 100 octane, fuels are given "performance numbers" instead of octane ratings, so oilmen generally credit propane with a 125 performance number as an anti-knock rating. That's 25 points higher than most aviation gasoline.

Butane, by the way, is also a source of aviation gasoline when two hydrogen atoms are knocked off the molecule to form butylene. Another derivative that plays an important role in industry is butadiene—butane with four hydrogen atoms knocked off—used in synthetic tire rubber.

About two gallons of LPG can be recovered from the average 1,000 cubic feet of natural gas. Liquefied petroleum gas also comes from crude oil—about a tenth of a barrel of it to every barrel of crude brought in.

America's great poverty of riches in LPG and propane lies in its vast natural gas reserves. Those now known amount to 180,000,000,000,000 cubic feet. More than half of that is on the Texas Gulf Coast. That's why Texans would like to get rid of more propane—profitably. The only reason propane isn't burned more generally is the difficulty in handling. It must be transported to distribution points in special pressured tanks. Special nozzles are required to refill a vehicle's propane fuel container. A propane-propelled truck, bus, or tractor must have a special pressure-reducing distribution system leading from the fuel tank to the carburetor because the liquid must become a gas before it can be burned. The carburetor itself is a special job, without a float bowl or needle valve. It

merely acts as a mixer for air and gaseous propane.

And propane demands a high-compression engine for performance. The Twin Coach Co. of Kent, Ohio, leading manufacturer of propane-burning buses, uses a 10-to-1 compression ratio. The highest ratio used in production automobiles so far is 7.8-to-1.

While propane is sold in every state, it's harder to get than gasoline. You can't just run down to the corner filling station.

But fleet owners find the results well worth the investment in specialized equipment. First off, propane costs in mid-continent, where most of it is produced, a fourth to a half less than gasoline. It is 10 to 40 percent cheaper than Diesel fuel.

Propane is a clean engine fuel. One California fleet owner has a truck he runs 90,000 miles between overhauls compared with the 30,000 he ran with gasoline.

Burned propane leaves no spoor like Diesel oil or gasoline. Vapor locks are unknown. Because it burns more slowly than gasoline and more progressively, it exerts a steady pressure, like steam, against the piston head—so wear on bearings is reduced. And finally, propane whips the bugaboo of carburetor engines—an unequal distribution of fuel among the cylinders. With propane, each cylinder gets a like charge of wholly dry gas.

While the Phillips Petroleum Co., of Bartlesville, Okla., the world's biggest producer of liquefied petroleum gas, would be the last to deny it can be dangerous, serious accidents have been few. The strength of propane-burning vehicles' fuel tanks almost obviates unhappy results in the event of collision. Locks and valves in the fuel system are designed to prevent accidents.

The Phillips people go further, and they ought to know what they are talking about. They pioneered the utilization of the gas when natural gas companies were letting it evaporate to solve the problem of disposal.

They say that even in the unlikely event of a tank puncture in a highway crash, the gas usually vents and burns if ignited, rather than exploding. A Spokane motor coach company operated a fleet of 133 vehicles on propane for 10 years for a total distance of 40,000,000 miles with virtually a perfect safety record.

LPG a Veteran

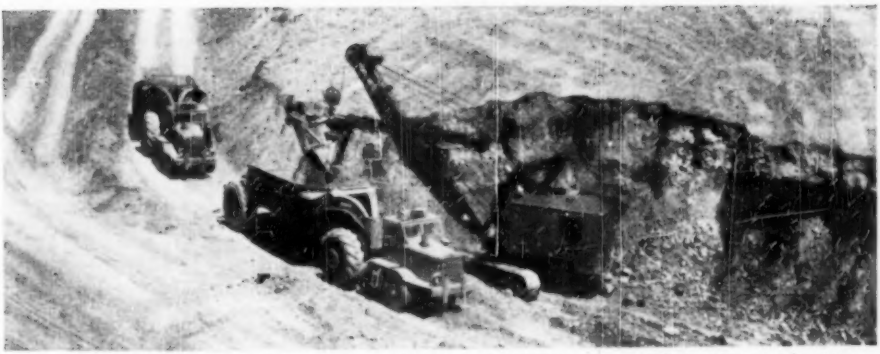
Propane isn't new. Or, rather, LPG isn't new. It was known at the turn of the century, and back in 1914 a car was run on it in New York City. There are several dozen private cars using propane today. All told, close to 200,000 trucks, buses, farm, and earth-moving machines are today burning propane or a propane-butane combination.

During a visit to Bartlesville I climbed into an Oldsmobile propane test car to see how it felt on the road. The car had a 10-to-1 compression ratio and presently was to be tried out at even higher ratios. I saw no difference between its performance and that of a standard Olds using Ethyl gasoline, but for one thing: I couldn't make the engine ping.

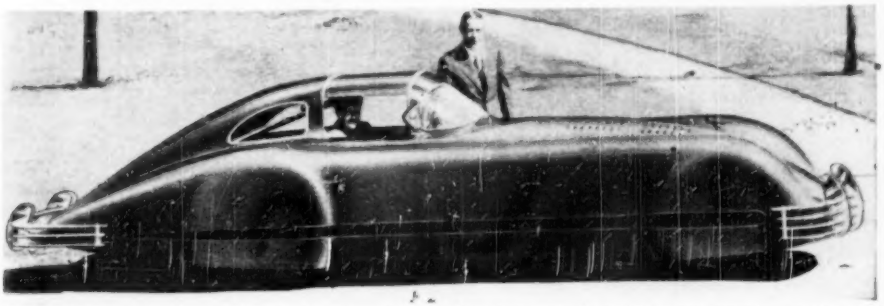
As I slid out of the seat after the drive I asked a Phillips executive, "I don't suppose this stuff ever will be used in private cars?"

He rubbed his chin. "I'd hate to bet money it wouldn't," he replied. END

Farmers are converting tractors to use "bottle gas" because it's cheaper than gasoline. The tank on front of this machine contains the same gas as is used for cooking in farm kitchens.



Earth-moving equipment is being powered by natural gas by-product. Here at Garrison Dam, on Missouri River below Fort Peck, Mont., tractor-truck has motor adapted to propane.



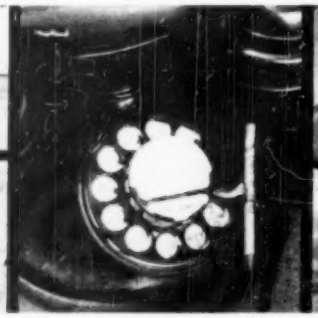
L. J. Fageol, president of Twin Coach, drives this 275-hp. propane sports car. Specially built for him, car has 10:1 compression ratio and has been clocked in test at 135 m.p.h.

Latest wrinkle in cargo carriers is this motorized giant powered by propane engine. Gas even has been used by an Oklahoma carburetor company to run a 4-passenger light airplane.

Aids to Modern Living

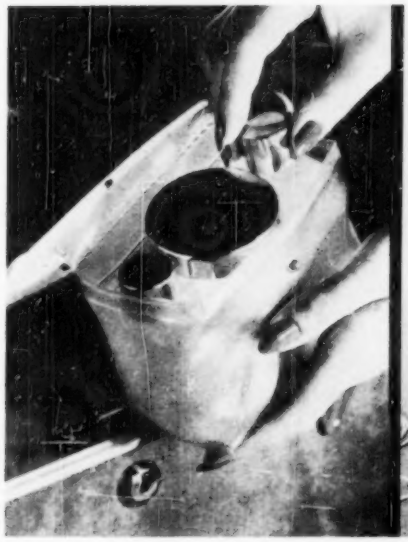
Hassock Is Storage Chest. When the lid of this combination hassock and chest is closed, it doubles as an extra seat. Made by Ero Mfg. Co., of Chicago, the bin is covered with washable, scratch-resistant plastic.

Pail Has Oval Shape. Designed to accommodate wide sponge-rubber mops, the oval pail above has a bottom shaped so it won't topple off stairs or ladders and spill the contents. Nesco, Inc., of Milwaukee, Wis., introduced the new tip-proof wash pail.



Memo Pad Fits Phone. Messages can be quickly jotted down on paper disks in this refillable pad holder that clips onto the center of the dial. The pad, including a pencil, is priced at $1.25 by Dial-O-Pad Corp., Brooklyn, N. Y.

Midget Extinguisher. Unlike many fire extinguishers, the pocket-size Presto above has a shut-off valve that permits it to be used more than once before it has to be refilled. It's sold by Lewis & Conger, New York City, for about $4. Refill costs $1.85.

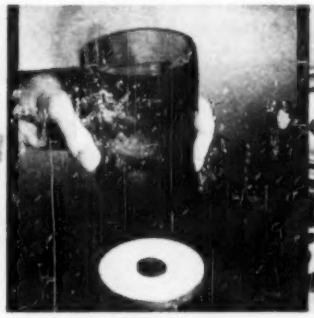


Plastic Saves Lotions. Creams and lotions packed in a suitcase are less apt to spill if carried in the unbreakable, flexible polyethylene containers fitted into this cosmetic case. The set is priced at about $3 by Simmons Kit Co., New York City. The plastic case resists abrasion.

Radio Has Button Earphone. Instead of a bulky headband, this pocket radio has a hearing-aid type of ear plug for listening. The set is turned on by pulling out its telescoping antenna. Privat-ear Corp., The Bronx, N. Y., prices the receiver at about $24.

Tube Switches on Lamp. To light this floor lamp, just give its shaft a twist to the right; to turn it off, twist it to the left. A special toggle switch hidden at the top of the tube permits this action. Made by Calpa Products Co., of Philadelphia, Twist-A-Lite is priced at about $26.

Tool Rack Is Adjustable. This new holder keeps odd-size tools within easy reach. Its aluminum grips, separated by sponge-rubber pads, slide in a track so tool openings are self-adjusting. R. K. Products Co., of Portland, Ore., sells the holder for $1.49.



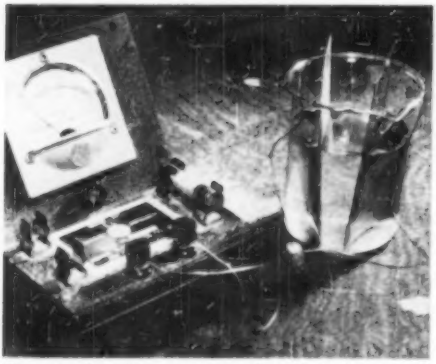
Coaster Blots Drips. Iced drinks won't drip if the coaster above is fastened to the bottom of a glass by its suction cup. Made of plastic, the coaster has a blotter to absorb moisture. Bates Products, Burbank, Calif., sells eight for $1.

Can Punch Pries, Too. Besides having punch prongs for making large and small holes in cans, this opener has a screwdriver tip that pries lids off containers. Available from the Punch-a-Can Co., of Canyonville, Ore., the tool is priced at about 40 cents.

Brushed on casement window, Zinkrich acts on metal to form rustproof, galvanized surface.

Rustproof Compound Can Be Brushed On

IN THE constant battle of iron and steel against corrosion, zinc, the hero of the galvanized pail, has become an established favorite. But to apply its protective coating required an elaborate method of hot-dipping the object to be protected in a bath of molten zinc. Now you can get a cold-galvanizing compound, called Zinkrich, that can be applied by brush, knife, or spray.



Two steel strips, one coated with Zinkrich and other bare, are immersed in salt solution. Millivoltmeter reading shows that current is set up by chemical action between strips. Similar action occurs between Zinkrich and any iron or steel surface painted with it, locking coating on.

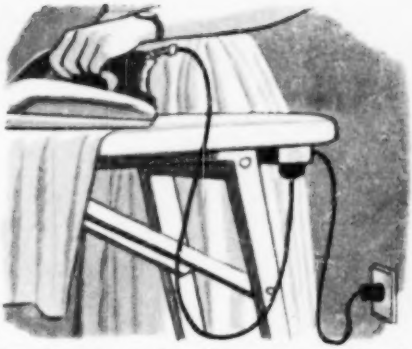
Developed in England and distributed in the U. S. by the Zinkrich Co., of New York City, the new compound consists of 95 percent finely ground zinc dust, suspended in an electrolytic fluid. When applied to iron or steel, an electrochemical action takes places that arrests the spread of rust and binds the zinc to the base metal by galvanic action.

Except for small articles and thin sheets, treated in quantity, the new material is cheaper than hot-dipping and can be applied in any thickness desired. Uses range from ships to the homeowners' casement windows and include steel fences, fire escapes, gasoline tanks, auto bodies, machinery, threaded pipe, and any household objects subject to corrosion.

Surfaces to be treated should be cleaned of grease, paint, dirt, loose rust, or scale. Large rusty areas should be cleaned to the bare metal every foot or so to provide an "anchor" for the compound. Spraying with water an hour after application reveals any weak spots, which can be recoated. The surface becomes hard enough for heavy use after 48 hours.

Keeping the Home Shipshape

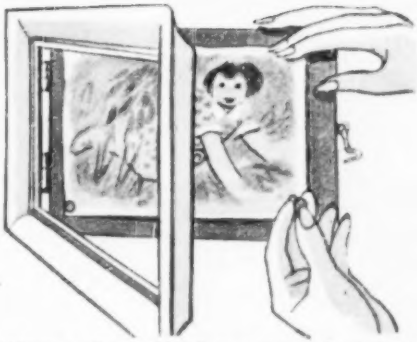
Save cardboard cartons of a single size until you have enough to fit together on your closet shelf. Covered with cold-water paint, they provide neat storage for hats and handbags.



Attach a receptacle under your ironing board and connect up some heavy-duty wire as an extension. Then you won't have to set up the board so close to an electrical outlet.

Do your children scuff the tips of their shoes? Try brushing several layers of shellac over the tips after shining shoes. This helps hold the gloss and protects the leather.

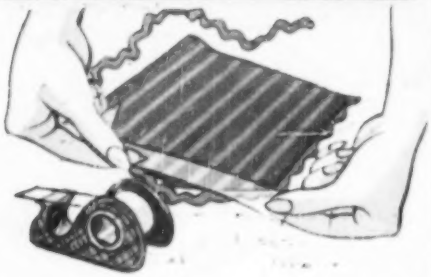
A hard maple board makes a fine top for any kitchen working surface. If you can't find a board that fills the whole surface, piece it out with some pine of equal thickness.



Hinge a plywood back to a picture frame and you can change pictures without removing the frame from the wall. Paste the mat on the glass and thumbtack pictures to the plywood.

Please turn the page for five more suggestions.

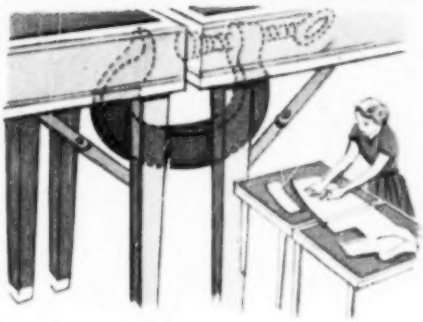
Keeping the Home Shipshape



Don't baste when using rickrack or lace to trim. Use cellulose tape to hold it in place. When you machine-sew, you can see through the tape, which is easily removed after stitching.

Worn spots on a rug, showing white stitching and exposed seams, can be concealed by careful tinting with fabric paints or photo-coloring dyes mixed to match the rug.

If you scissor your steel-wool pads in two, you'll beat the rust bugaboo. The smaller pieces are big enough for any scouring job, but discards from rust will be halved.



A pair of card tables, clamped together underneath with two C clamps, make a fine cutting table. Removable wooden lifts will raise the tables to a convenient cutting height.

Your floor-painting and repairing jobs will be easier if you have a movable kneeling pad. Just add casters to a block of wood, pad with foam rubber, and cover with a tough plastic.

MECHANICS
and
HANDICRAFT
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Lights Out of Doors Say Merry Christmas

By R. L. Biesele, Jr.
Head of Electrical Engineering Dept., Southern Methodist University

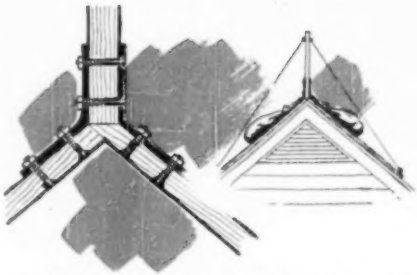
THE owner of the house shown above lighted it up for Christmas in all four of the most popular ways. He not only *outlined the house*, but also *silhouetted the shrubbery* with his lights. Then he added both *a Santa Claus cutout* and *a Biblical scene*.

In one, two, three, or all four of these ways, your home, too, can be made so attractive that people will go out of their way to see it. Look how charming and inviting the holiday lights make the plain little house at the right.

On the next four pages you'll find suggestions and explanations of how you can make your home—big or small, old or new—sparkle on Christmas Eve.

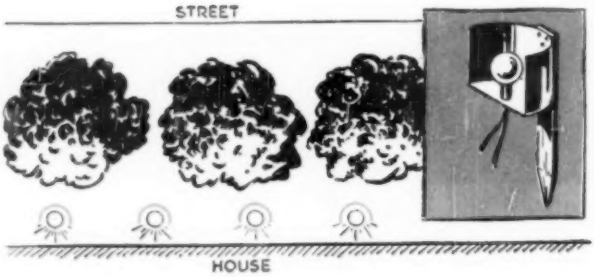
Outdoor lighting need not be expensive.

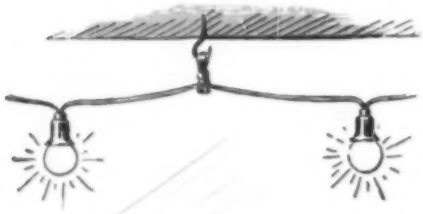
Cutout figures like the Santa Claus at left can be made of wallboard, painted, and then outlined with colored lights. Drill holes to fit sockets and screw in bulbs from the front. Keep in mind both the day and night appearance of your work. And be sure to use outdoor lights. A stake in the ground will hold this cutout upright



A cutout can be mounted on a peak or gable without nailing into the roof by putting it on a simple wooden saddle. Its legs should be twice as long as cutout is high. They can be bolted to the upright with bent angle brackets. Sandbags can be used to add weight and guy wires or ropes to make the cutout sturdy.

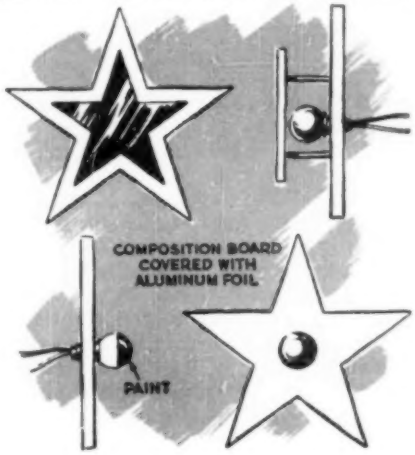
Shrubs and trees can be silhouetted by directing light at house. Shield bulbs on bush side with halves of coffee cans cut vertically. Wrap tape around weatherproof sockets to hold them in holes in bottom of cans. Then festoon trees with bulbs, and they'll really glitter.



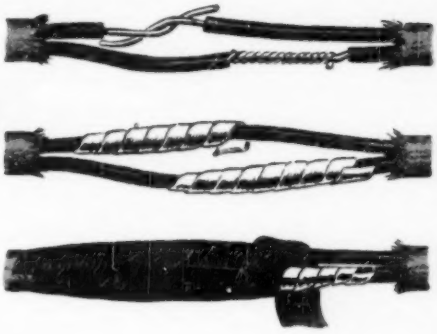


Lights outlining home can hang from permanent hooks, spaced so the wind doesn't bang bulbs against a wall. Wire should be hung by tape or cord loops so that it will not rub against the metal. Many decorators prefer to support the wires on porcelain insulators. Warning: Never drive nails through the wires.

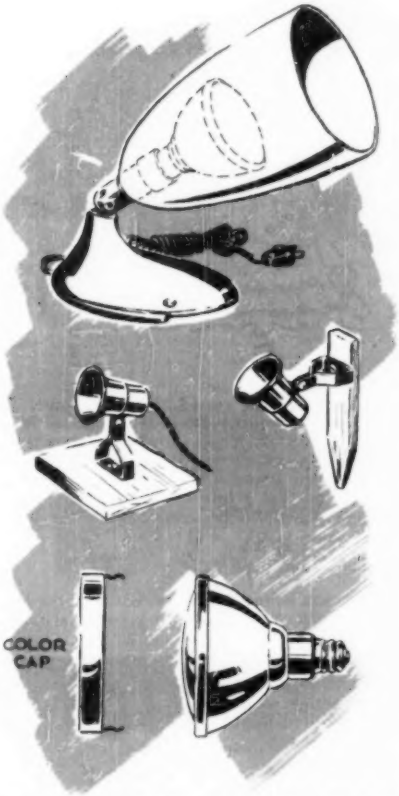
A lighted star nearly always helps. Two ways to make one are suggested by sketches below. Star can be placed over doorway or on roof.



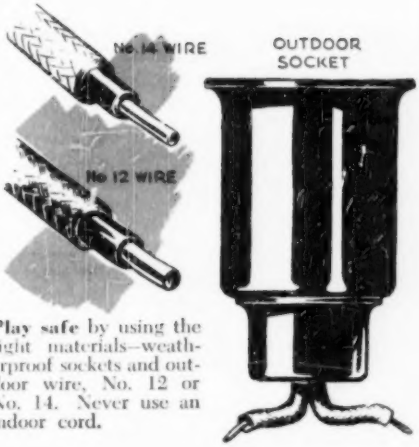
Wiring the lights right is as easy as 1 - 2 - 3.



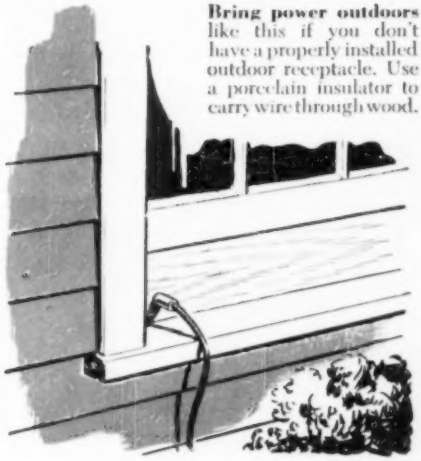
Use the underwriter's knot, shown above, whenever you attach a plug to your wire. This knot helps keep wires from pulling loose at screws. And when you splice wires, bare enough of each one to make a tightly wound splice. Stagger the splicing, as shown in sketches at right, then wrap tightly with electricians' tape.



Weatherproof holders are required for flood and spotlights. Two adjustable types are seen here. With the kind in center you can use a lamp with built-in reflector. If available, a color cap over the lamp will enable you to produce some novel lighting effects.



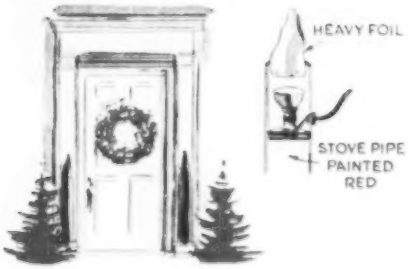
Play safe by using the right materials—weatherproof sockets and outdoor wire, No. 12 or No. 14. Never use an indoor cord.



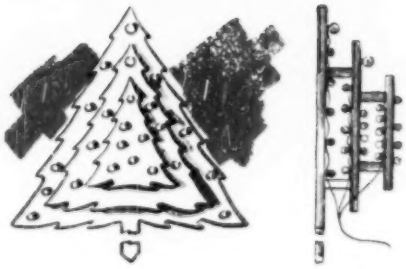
Bring power outdoors like this if you don't have a properly installed outdoor receptacle. Use a porcelain insulator to carry wire through wood.

Choose the method that's best for your house.

This doorway says "Come right in," because of the way lights lead to the star above it.

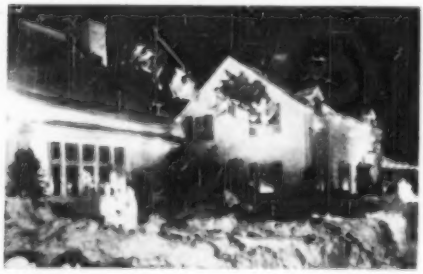


Candles at the doorway. You can make a pair of big ones from stovepipe or downspouting. Nail a wood disk or similar support into the upper end of the pipe for a socket and 150-watt floodlamp. Shape a flame from heavy foil, backing it with composition board if necessary. Paint pipe red and floodlight the door.

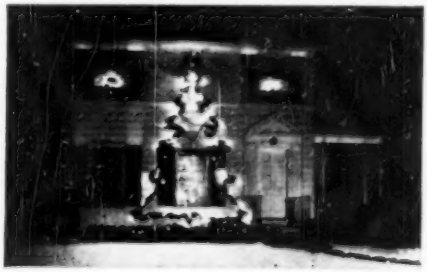


No trees in your yard? Make your own. Triangular shapes cut from composition board will do the trick. You can use just one triangle —or several as above. Press the sockets into holes in the board and put the wires behind. Paint trees flat white or dark green. Pieces of foil or tin can be used behind the bulbs.

Santa and his reindeer ride the sky in the photo below. This dramatic cutout was put up and lighted by cooperating neighbors.

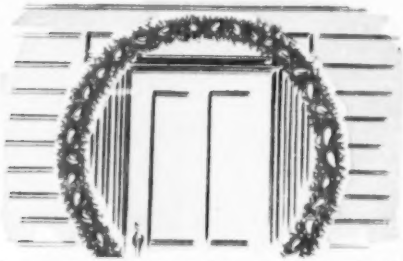


Evergreen branches tied to wires on the front of this home form a Christmas tree that frames a window through which indoor tree is visible.

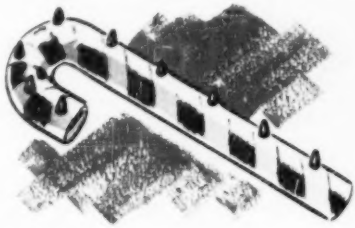


A shadow picture can be obtained by placing a floodlight in front of a cutout. Position the light and cutout so the shadow will fall on a plain part of the house. Cutouts similar to this can either be made or purchased in the stores.

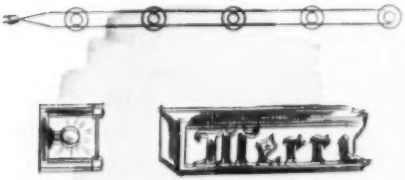
A floodlamp in a tree lights up Santa Claus cutout on a garage door in this case. A garage door frequently offers a good background for achieving spectacular Yule lighting effects. A floodlight has twice the spread of a spotlight.



A wreath around the door can be made by covering chicken wire with layers of evergreens. Dot the wreath with bright red lamps. To really impress the neighbors, throw a 150-watt incandescent floodlight on your wreath.



Huge peppermint candy cane consists of sections of downspouting. Wrap strips of red and white oilcloth around it. Put bulbs through drilled or punched holes, leaving sockets and wire inside. Hang it from a tree.



An electric sign is always a good bet. Make it by building a narrow wood box and putting glass in slots on one face. Wire porcelain sockets as shown about six inches apart. Use 25-watt bulbs of the same color. Paint glass and inside of box white. Lettering can either be painted or cemented on the glass.

"Yes," you may be thinking now, "I'd like to light up my home, but I haven't time." Look then at the picture at the right—which shows what can be done with a single floodlight and cutout. Maybe that's all you would need.

FIRST. Jack Haley and Cliff Edwards having fun on Jack Haley show, WNBT, New York. Dick Schuler, Bronx, N. Y., took the photo with a 4" by 5" Burke & James press camera on fast pan film. Exposure: 1/25 sec. at f/4.5.

From Readers' Albums of Television Photos

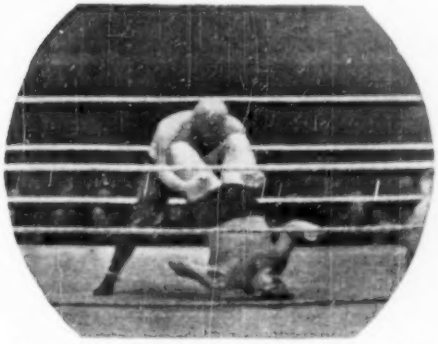
THESE are photos of images on video screens in POPULAR SCIENCE readers' homes. Those on this page were chosen as the best among more than 500 entered in the competition for cash prizes announced in August. Runners-up are on the next page.

All were taken at slow speeds with wide apertures and fast film. Some photographers tried high speeds and got pictures, but the judges held that these were better.

SECOND. Actress Nydia Westman on Dinner at Sardi's, telecast from WOR-TV in New York. William G. Baldwin, Carteret, N. J., used a 2¼" by 3¼" Busch Pressman camera, fast film. His exposure was 1/25 sec. at f/4.5.

THIRD. Rise Stevens and Fred Allen on the Fred Allen Show, from WNBT, New York. The photographer, John F. Ruppel, Jr., Malverne, N. Y., used a Ciroflex camera and made the exposure at 1/25 sec. at f/3.5 from a 10" tube.

History in the making. Russia's Jacob Malik, left, and Warren Austin, U. S. representative, at their desks during the stormy August session of the United Nations Security Council. Donald Cohen, of Jamaica, N. Y., shot the two photos from a WNBT telecast. He used a Bolsey B 35-mm. camera loaded with Plus X film. His exposures were 1/10 sec. at f/3.2. The film was first developed for 10 minutes in Ansco 17 developer and then reduced a bit.



Wrestling. This type of TV shot is one of the most difficult. George E. Brown, of Toledo, Ohio, took it during a local bout telecast by WSPD-TV, Toledo. He used a 4" by 5" Speed Graphic, exposing for 1/25 sec. at f/4.7.

Drama. Rita Colton and William Windom get together in Shakespeare's Richard III, WNBT, New York. Michael Benvengo, Brooklyn, N. Y., put a portrait lens on his Argoflex and exposed at 1/10 sec. and f/4.5 on Super XX.

John Cameron Swayze extends season's greetings on a news program. Ross W. Garrett, of Lancaster, Pa., shot the photo from his local station, WGAL-TV. The exposure was 1/25 sec. at f/4.5 with a "23" Crown Graphic.

Singer. Fran Warren lets loose a high note on Toast of the Town, WCBS-TV, New York. Charles A. Ligibel, of Jersey City, N. J., made the exposure with a Recomar at 1/25 sec. and f/4.5 on Super XX film. Developed in D-76.

Simple Ways To Fix Toys

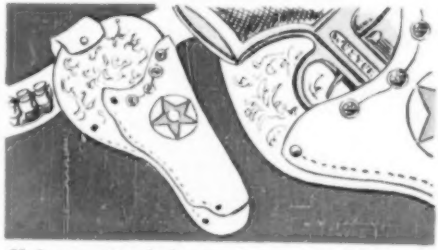
YOU and all the rest of Santa's helpers will be busy from now until Christmas Day, but don't forget to take time out for those old toys. You've probably noticed how a child sometimes forgets his new toys shortly after Christmas and returns to an old one. If you ask why, the usual answer is, "I just like it better."

Many old toys have lots of life left in them. A little work—sometimes only a new paint job—and they're back in the running with the new toys. A few quick and easy fixes are shown on these two pages.

Plastic toys. Most of these are molded from polystyrene, which can be cemented with its solvents, among them acetone and chloroform. Apply enough to soften the surface, squeeze together, and hold until solvent evaporates. A good cement for polystyrene is available from Koppers Company, Inc., New York, at $1.20 a pint. Heat softens polystyrene and it can be "puddled" together with a soldering iron, a useful dodge if you have no cement. This also makes a quick fix where repair doesn't show, as for example where axle slots in toy cars have enlarged or sprung enough to let the axle pull out. Use the soldering iron to push the hot, softened plastic together over the axle.

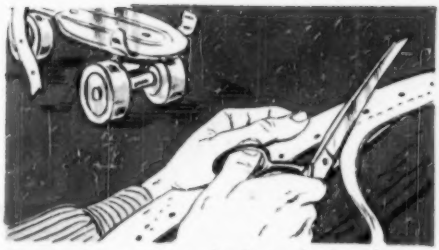
Flexible plastic toys can usually be repaired with acetone. Non-oily nail-polish remover may also serve if acetone isn't at hand. Apply the solvent freely to the break, place the surfaces together, and hold with rubber bands, clothespins, or paper clips until the acetone has fully evaporated.

Cowboy hat. Dry-cleaning fluid will take out the spots. Iron brim under damp cloth. Wad up rags in crown and run iron over outside of crown. Add a bright new cord around the brim.

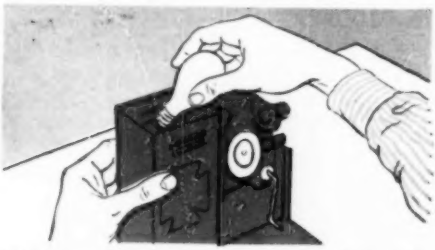


Holsters. Quick draws often tear leather at the rivets. Refasten through undamaged material nearby, using split or tubular rivets with burrs (washers) under the end you hammer.

Telephone. Spring that returns dial often pulls loose. Spring is attached to underside of dial and to base of phone. Remove dial, drill hole, and hook broken end of spring through hole.



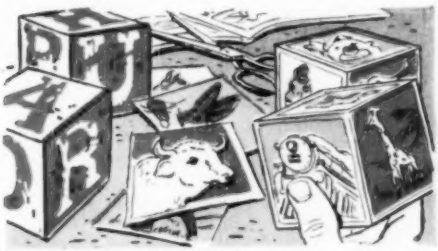
Roller skates. New wheels can be bought at a toy shop or hardware store. Cut new straps from an old belt. If clamps are lost, use straps. Give skates a good cleaning and oiling



Movie projector. New spool brackets can be bent from coat-hanger wire, filed to fit body slots. Make certain the film gate works freely, and that electric cord and plug are okay.

Mechanical boat. Judicious straightening of a bent propeller shaft often gets these out of dry-dock. If prop is bent beyond repair, cut a new one from tin plate and solder it on.

Trucks and autos. Press out dents from inside, using a blunt stick and hammer on stubborn ones. Spool ends, jar lids, or wooden disks make fair substitutes for missing wheels.



Building blocks. Re-cover with colorful wall-paper scraps or clippings from picture books. Stick colored Scotch tape along all the edges to frame the picture and reinforce the blocks.

Doll. If eye mechanism is broken, remove wig and stuff head with cotton to hold eyes in open position. Retouch worn color with nail polish. Restring loose limbs with strong elastic.

How to Refinish Your Floors

By Bernard Gladstone

PS PHOTOS BY W. W. MORRIS

With machines you can rent, you can do a professional job. Here's the know-how.

AS LIVING costs rise, you're probably eager to cut as many corners as you can. I know I am. That's why I refinished my own floors. It was work, all right, but I saved about $70—and the three floors that I redid look like new.

I shopped around among several floor refinishers and got estimates ranging from $80 to $90 for the floors I wanted redone. But I found I could do all three rooms myself for about $20 if I rented two sanding machines and a buffer.

These machines are rented by the day. You can sand three average-size rooms in one day. So it's cheaper to do three rooms at a time than to prolong the job by doing each room on a different day.

Here's what you'll need:

- Drum-type floor sander,
- Disk-type floor sander, called an edger,
- Hand scraper,
- Buffer,
- Finishing materials (see the data card on page 173).

Strip the room clean of hangings, pictures, and blinds as well as all furniture. The sander will leave a coat of dust that settles over everything in sight, so the more furnishings you remove, the less cleaning you will have to do afterwards. If your home is heated by radiators standing out in the rooms, disconnect them so they can be moved around if necessary.

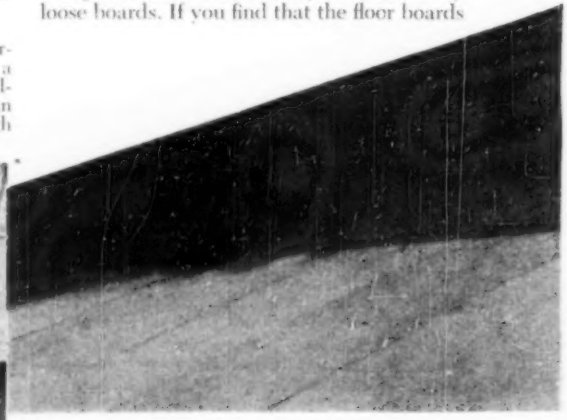
Preparing the floor. Go over the whole floor and check for loose, squeaky boards and protruding nail heads. Use a hammer and nail set to sink exposed nail heads. Then fill the holes with composition wood.

Squeaks in a floor usually are caused by loose boards. If you find that the floor boards

Above: Driving a 2" finishing nail at an angle of 45° into a squeaky board anchors it to an adjoining board, silencing it.

Left: To avoid marring the floor with hammer, a nail set is used to punch head below surface instead of driving it all the way in.

Below: Loose subflooring must be nailed to a joist. Drilling from cellar marks joist. Nail can then be driven through floor to it.



Here's a trick (left) that will take some strain of sanding off your back. Wrap a rope or wire around your waist and loop it over handle of the sander.

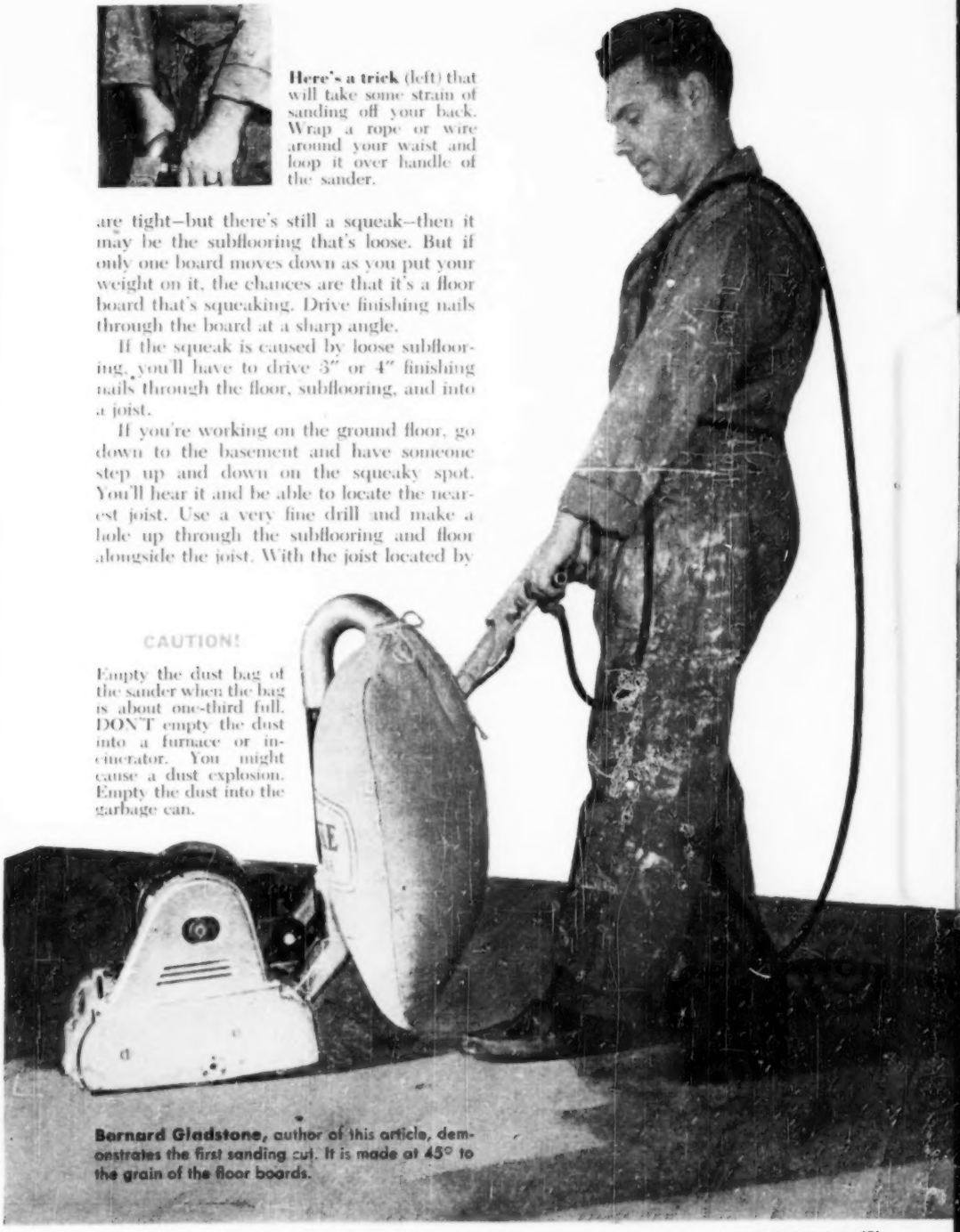
are tight—but there's still a squeak—then it may be the subflooring that's loose. But if only one board moves down as you put your weight on it, the chances are that it's a floor board that's squeaking. Drive finishing nails through the board at a sharp angle.

If the squeak is caused by loose subflooring, you'll have to drive 3" or 4" finishing nails through the floor, subflooring, and into a joist.

If you're working on the ground floor, go down to the basement and have someone step up and down on the squeaky spot. You'll hear it and be able to locate the nearest joist. Use a very fine drill and make a hole up through the subflooring and floor alongside the joist. With the joist located by

CAUTION!

Empty the dust bag of the sander when the bag is about one-third full. DON'T empty the dust into a furnace or incinerator. You might cause a dust explosion. Empty the dust into the garbage can.



Bernard Gladstone, author of this article, demonstrates the first sanding cut. It is made at 45° to the grain of the floor boards.

On floors that have extremely uneven boards, you may have to make first cut at 90° to the boards to get the old finish out of valleys.

Final sanding with each of three grades of paper should be done with the grain. Keep sander moving. Don't stop it with drum on floor.

the hole, you can go upstairs and drive the finishing nails.

When the joists are concealed by a ceiling, you can locate them by tapping the ceiling lightly with a mallet. You'll get a solid rather than a hollow sound when you're tapping below a joist. Joists are normally set 16" on centers. After you locate one by tapping on the ceiling, measure from the wall to the joist. Then go upstairs and repeat the measurement on the floor.

Sanding. The drum sander is the larger of the two sanders. It will do the bulk of the sanding. But it can only go within two or three inches of the baseboard. The edger is used to sand the rest. In corners—where even the edger can't reach—you'll have to use a scraper and sandpaper.

The man you rent the machines from will show you how to operate them and how to change sandpaper.

Go over old floors with three different grades of sandpaper—4-16, 2½-30, and ½-60 in that order. Use the same grades of paper in both the drum sander and the edger. If you are sanding new, unfinished wood, skip the sanding with 4-16 paper.

Always start the machine with the drum off the floor. Move slowly forward as you lower the drum to contact the floor. Continue walking slowly forward. As you approach the end of the forward cut, raise the drum from the floor before the machine comes to a stop. Then start the backward cut by walking backwards, making sure the machine is in motion before the drum touches the floor.

Don't place weights on the sander or lift up on the handle to increase pressure of the drum on the floor. The drum load of the machine has been set at the factory to exert just the right pressure.

Generally speaking, all sanding should be done backward and forward with the grain. But, to eliminate unevenness in the floor boards, the first cut is sometimes made at a 45 degree angle to the grain.

After rough sanding (4-16 paper) the

Since drum sander won't reach right up to baseboards, an edger (left) is used to remove the final two or three inches of old finish near the walls. Even the edger—a disk sander—won't reach into all corners. A scraper (center) is needed for this job. After taking off as much of the previous finish as you can with the scraper, wrap a piece of sandpaper around a block of wood (right) and smooth out the corners to match the rest of the floor.

whole floor, finish up with the edger, using the same grade of paper. Then go back to the drum sander and make your second cut with the grain, using 2½-30 paper. Follow with the edger. The final cut with both drum sander and edger is made with ½-60 paper.

When you've finished sanding, take off your shoes before walking on the raw wood. Your shoes might leave dirty foot marks on the floor.

Clean up. Before starting the finishing operation, get all the dust out of the room. The easiest way to do this is with your vacuum cleaner. Then go over the woodwork with a damp cloth to get any dust the cleaner may have missed. Don't forget the tops of doors and door and window frames. Any dust left in the room may be disturbed during the finishing and settle on the still-wet finish.

Finishing. Three finishes that are frequently used are described on the data card below.

You don't need to use a filler with floor seal. But for a smooth shellac or varnish finish on open-grain hardwoods—such as oak—you should use a paste-wood filler. Thin the filler to brushing consistency with turpentine. Brush it on across the grain, working only a small area at a time because it dries quickly—in about 10 minutes. Watch it carefully and as soon as it begins to dry or get dull, wipe off the excess. Wipe across the grain with a piece of clean burlap. Then let the floor dry for at least 12 hours.

Next rub the floor with No. 0 steel wool, working with the grain. An easy way to do this is to tie the steel wool to a push broom. Sweep up all dust and grit left by the steel-wool rubbing.

If you want your floors darker, stain them after using the filler. Or, you can save time by mixing a little color in oil with the filler. There are several ways, in fact, to darken the finish: For a darker shellac finish, use orange shellac instead of white shellac; for a darker varnish finish, use a colored varnish stain for the first coat; for a darker floor seal finish, use a colored seal. END

Finishing touch for your refinished floors is waxing. Renting a buffer will save you time and work, and is well worth the money.

FLOOR FINISHES

TYPE FINISH	CHARACTERISTIC		HOW TO APPLY		
	ADVANTAGES	DISADVANTAGES	1st Coat	2nd Coat	3rd Coat
Shellac	Dries quickly in from 1 to 2 hours. Does not darken wood.	Very brittle. Water causes it to turn white. Scratches easily.	5-lb. cut shellac thinned 3 parts shellac to 1 part denatured alcohol. Let dry 2 hours.	5-lb. cut shellac, thinned 4 parts shellac to 1 part denatured alcohol. Let dry 4 hours.	Paste wax rubbed in well, and buffed when dry.
Varnish	Film is tough yet flexible. High scratch resistance. Does not stain or water-spot easily.	Slower drying. Room cannot be used for over 36 hours. Tends to darken wood.	Floor Varnish thinned 6 parts varnish to 1 part turpentine. Allow to dry about 12 hours.	Floor varnish straight from can. Allow to dry about 24 hours.	Paste wax rubbed in well, and buffed when dry.
Floor Seal	Does not require filler. Penetrates into pores of wood. High scratch resistance. Waterproof.	Takes more work as each coat must have surplus rubbed off. Slower drying than shellac.	Brush on full strength. Allow to penetrate for 15 or 20 minutes, then wipe off excess with clean mop or burlap rag.	Same as first coat. Allow 6 hours between coats.	Paste wax rubbed in well, and buffed when dry. Dry 8 hrs. before waxing.

FOR YOUR POPULAR SCIENCE INFORMATION FILE

When Gus had unscrewed the radiator cap, he called to his assistant, "Now hit that starter button again, Stan."

Gus Fixes the Local Scrooge

The veteran Model Garage owner loosens up a tightwad—and helps a good cause as well.

By Martin Bunn

GUS WILSON was sitting on a stool in front of his bench in the Model Garage repair shop reading a letter and munching one of his lunchtime sandwiches.

"You Gus Wilson?"

It was a harsh, rasping voice, and Gus looked up to find its owner to be a large, bulky man who seemed even bulkier than he was because of the fur-collared storm coat he was wearing.

"That's right," Gus answered, putting the letter and his sandwich on the bench and slipping down off his perch.

"Supposed to be quite a man with automobiles, aren't you?" the big man boomed sarcastically.

"I'm a mechanic," Gus replied.

"Why, the way I hear it, you've never been stumped by anything that runs on gasoline," the bulky man boomed.

At that point, Gus had an overwhelming desire to answer sarcasm with sarcasm, but before he could speak his visitor went on, "My name's Purcell, William J. Purcell of Evansville."

Gus knew the name only too well, but he was blamed if he was going to acknowledge it. William Purcell was the wealthy owner of a lumber mill just outside Evansville, about an hour from our town. He was a sharp trader who'd made millions in one way or another and who'd never been known to spend any of it on anyone but himself. He held the unenviable position of being one of the most disliked men in our corner of the state.

A Big-Mouthed Big Shot

"You've surely heard of me," the big man boasted. "I own the biggest darned lumber mill in these parts—built it up from nothing. I . . ."

"Something we can do for you?" Gus interrupted coolly, wiping his hands on a scrap of waste.

"Of course, of course," Purcell blustered. "I don't drive a hundred miles just to pass the time of day in a crossroads service station. Something's wrong with my car and I want you to fix it. But I warn you, no guesswork. I've already been taken by most mechanics in Evansville and I don't intend to start supporting one in this town."

"What's wrong with it?" Gus asked.

"What's wrong with it?" Purcell repeated. "Why ask me, man? That's just what I've come to you

for. All I want to know is, can you fix it?"

"Well, Mr. Bucell," Gus answered, deliberately mispronouncing the name, "we can't very well fix it if we don't know what's ailing it. Where is the car?"

"Purcell, it's P-U-R-C-E-L-L," the big man spelled out. "The car's outside, and if we're lucky we may be able to get it inside."

At that moment, Stan Hicks, Gus's third arm, who had just come back from his lunch, started busying himself around the shop.

"Stan," Gus called, "will you go out front and drive Mr. Rochell's car into the shop so we can have a look at it?"

"The name's PURCELL," the big man exploded. "Co.afound it man, if you can't remember a name for a minute how the devil can you fix cars?"

Gus ignored the blast.

"Now, Mr. Purcell," he said when Stan had maneuvered the car into the center of the shop, "let's get down to symptoms and maybe we can put our finger on the ailment. What's wrong with it?"

It's Cold-Start Trouble

"Blamed thing won't start," Purcell explained, and then added, "that is, it won't start with the starter after it's been standing two or three hours. If the motor's warm, she'll tick right off when you push the starter button, but if she's cooled down she won't start unless I get someone to push me for a block or so. Once she does start, though, she runs fine. No trouble on the road, but park her for a couple of hours and you're in trouble."

"You've tried to have it fixed?"

The big man's face reddened. "Take a look at these," he grumbled as he pulled a sheaf of dog-eared bills from the pocket of his big coat and shoved them at Gus.

Although Gus is always a stickler for good workmanship and honesty, he had to chuckle inwardly as he riffled through the stack of bills. The mechanics in Evansville not only had tried just about everything, but had charged Purcell fancy prices to boot. The slips showed that the car now supposedly had a new condenser, a new coil, a new set of points, new plugs, a new distributor cap, a new battery, a new fuel pump, and a rebuilt starter motor.

"Well, can *you* fix it?" Purcell bellowed as Gus studied the bills.

Gus Asks Some Questions

"Maybe," Gus replied bluntly. "Tell me, how does the motor act after it's been standing idle for a few hours and you try to start it? Does it pop or backfire?"

"Doesn't do a darned thing. Just acts deader'n a door nail, and I can turn her over till the battery's dead and still nothing happens. But if I can get someone to push me, she'll generally take hold and purr along."

"Well, I won't promise any miracles," Gus said finally, "but if you want to leave it here we'll do our best."

"Fine," Purcell agreed, "but mind you, no fancy prices. I've a deal on here in town today so I can give you until five-thirty. If you haven't found the trouble by then, I'll pay you for your time. If you have found it, and fixed it, I'll pay you what you ask plus a bonus." With that, before Gus could reply, he stomped out of the shop.

"And who's that stuffed shirt?" Stan asked as the shop door slammed. "He acts like he owns half the county."

"That, Stan, is Purcell, William J. Purcell of Evansville," Gus mimicked, "and in the eyes of some people—particularly Purcell's—he does own half the county. What he hasn't made in the lumber business, he's made on mortgages. Well, enough grousing. Let's get at this fancy car of his. We've only got a few hours."

Others Had Tried and Failed

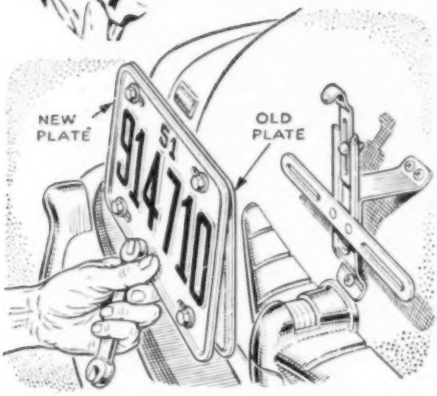
In checking over the bills again, Gus realized that most of the obvious possible causes for the trouble already had been taken care of without much in the way of results.

"Any ideas?" Stan asked as Gus dropped the bills on the bench next to his half-eaten sandwich and the letter he'd been reading when Purcell had come in.

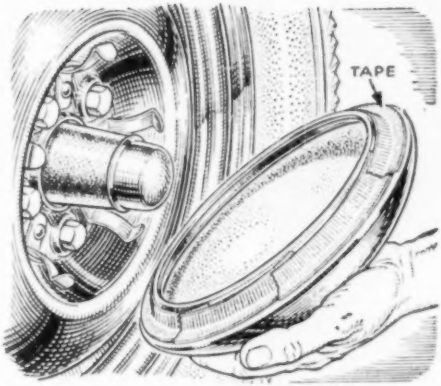
"One thing's for sure. The mechanics in Evansville seem to have taken care of

[*Continued on page 226*]

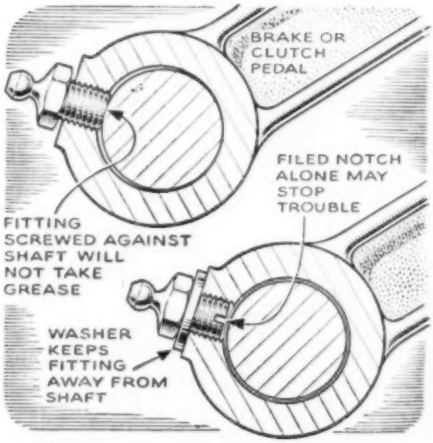
Hints from the Model Garage



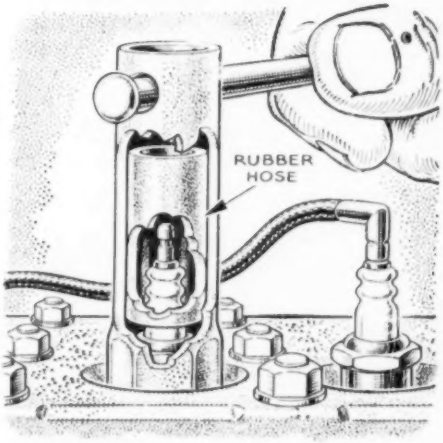
Old Plate Reinforces New One. Some states economize by making their automobile license plates out of thin-gauge metal. You can reinforce these—or any other plates—by reversing your old ones on the bracket behind your new plates.



Tape Protects Wheel Paint. The outer rim of a hub cap sometimes wears paint off the wheel, leaving a rusty ring. J. C. Branstetter, of San Francisco, has found that this can be avoided by placing strips of masking tape around the rim.



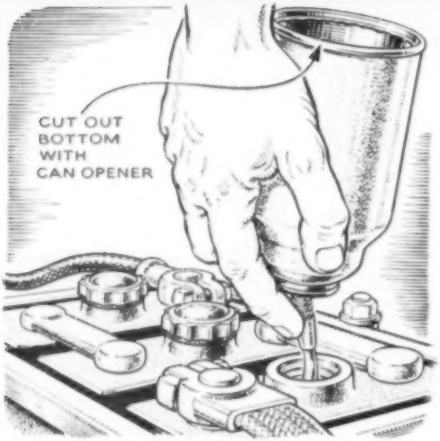
Refitting a Grease Fitting. If a grease fitting won't take grease, it may be that the end bears against the shaft, keeping the grease from getting through. Try a new fitting first. If that doesn't work, you can do one of two things—file a notch in the end of the fitting or use a washer as a spacer to hold it away from the shaft.



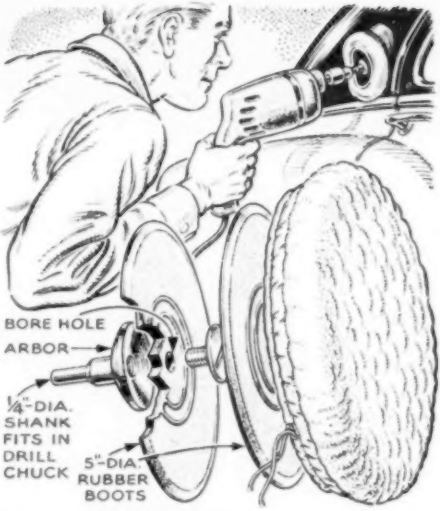
Hose Protects Spark Plug. When you are removing or replacing a spark plug, the porcelain may be cracked if the wrench slips to a cocked position while you are exerting pressure. To prevent this, Marion L. Rhodes, of Knightstown, Ind., suggests slipping a short piece of rubber inside the wrench to act as a cushion.

Turn the page, please, for four more auto hints.

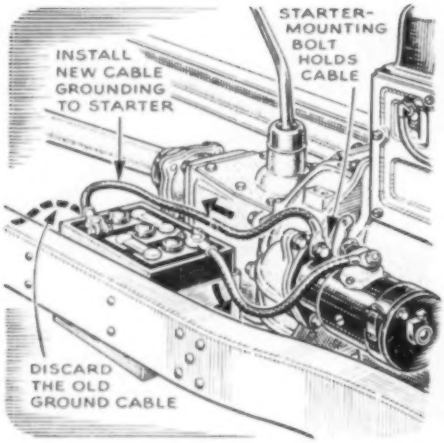
MORE Hints from the Model Garage



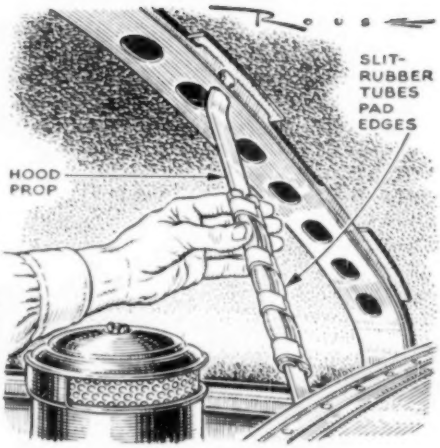
Can Makes Valved Funnel. Cut the bottom from one of the containers in which whipped cream is sold these days and you've got a handy funnel for such jobs as filling a battery. Pressure on the stem opens the spring-loaded valve.



Tire Boots Pad Buffer. Two tire boots make excellent backing for a buffing bonnet. Use the round kind that are reinforced at the center. Run the screw through only one. The other will then prevent scratches if the bonnet wears through.

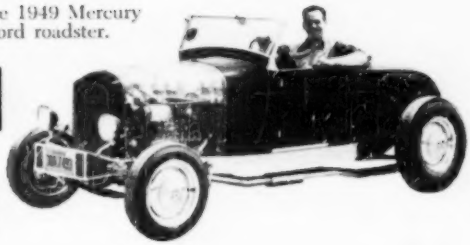


For Easier Starting. Your engine may start a lot quicker, especially in winter, if you transfer the battery ground lead from the chassis to the starting motor. With the battery grounded to the chassis, a rather high voltage drop sometimes occurs. The trick will work on both positive- and negative-grounded batteries.



Pad the Hood Prop. The swinging bar that's used in many automobiles to keep up the hood will be easier on your hands if you pad it with a strip of rubber tubing. Slit a length of tubing, slip it over the edge of the bar, and wrap adhesive or friction tape at intervals to keep the tubing in place. You'll find it handy in cold weather.

A plastic showcase displays the 1949 Mercury engine installed in this 1929 Ford roadster.

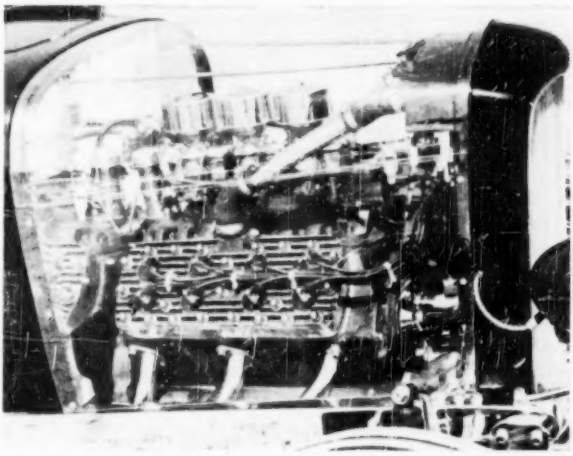


See-Through Hood Shows Off Engine

"MAKING a plastic hood is a cinch," says Ken Fuhrman, of Berkeley, Calif. "Anyone can do it who has a shred of mechanical ability and an engine he wants to show."

As proof, Fuhrman presents his own roadster, a trim speedster judged "most beautiful" in several shows. Kept sparkling, the plastic hood speaks for itself.

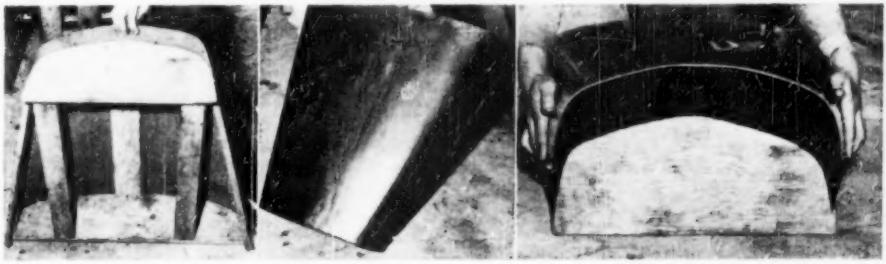
The flat sides were cut to size from sheets of clear plastic. Forming the curved top was more tricky—but easier than it looks. As the first step, a wood and sheet-metal form was assembled. The form and a sheet of plastic were then put into an oven preheated to 225-250° F. After the plastic had draped itself over the form, both were removed from the oven and the plastic "wiped" onto the form with a soft cloth.



Curved top lifts off when the metal trunk latches are unhooked. This permits the engine to be serviced without removing the flat hood sides. These are screwed in place.

Finding an oven big enough for the job caused some trouble. If you'd like to make such a hood, Fuhrman suggests that you find a plastic shop or a paint shop that specializes in baked-enamel finishes.

The curved piece was made oversize to permit trimming to fit. A keyhole saw, with plenty of set in the teeth, was used to trim off wide sections. Final delicate trimming was done with a coarse mill file. To prevent shattering, these operations were carried out with the plastic pressed against a solid surface. Only forward strokes of the cutting tools were used. Reinforcing strips of plastic were cemented around the edges of the hood. END



A form for bending top part of plastic hood was made from wood and sheet metal. Wood ends of form were cut to match the curves of cowl and radiator shell. The sheet metal was then bent and tacked to the wood. When heated, the plastic bent around the form as shown above.

Science in Your Car

You Can Make Rubber

With a 30-cent kit, you can perform simple home experiments that duplicate the magic of the chemists.

By Kenneth M. Swezey

YOUR tires, the radiator hose, and countless other parts of your auto contain milk-like latex—which came either from an East Indian rubber tree or a synthetic rubber factory.

For 30 cents, the U.S. Rubber Co., New York 20, N. Y., will now send you a sample of synthetic latex in a kit that also contains bits of natural and synthetic raw rubber, vulcanized tire rubber, sheeting, thread, and foam rubber. And with this kit, anyone can duplicate the magic of the rubber chemists.

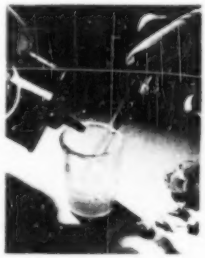
Latex consists of a finely divided suspension of solid particles in water. Dilute when originally produced, it is usually concentrated by "creaming." You can cream the latex from your kit by putting three tablespoonfuls in a tumbler and slowly stirring in a tablespoonful of a saturated solution of common salt. The latex will thicken and, if left to stand, will rise to the top like cream on milk.

To make a sample of rubber, slowly stir the creamed latex, and add a tablespoonful of vinegar solution (1 tbs. vinegar to 3 tbs. water). As you do this, the latex will change into a lump of rubber.

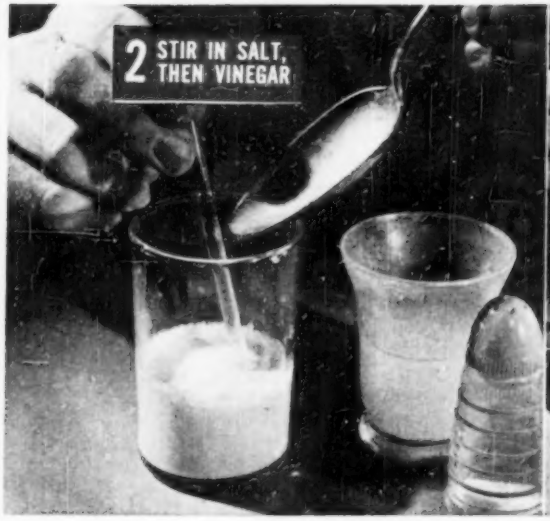
Raw rubber is made commercially in exactly the same way—by adding brine and acetic acid to latex. After being washed and dried, the coagulated rubber is pressed into sheets for further processing.

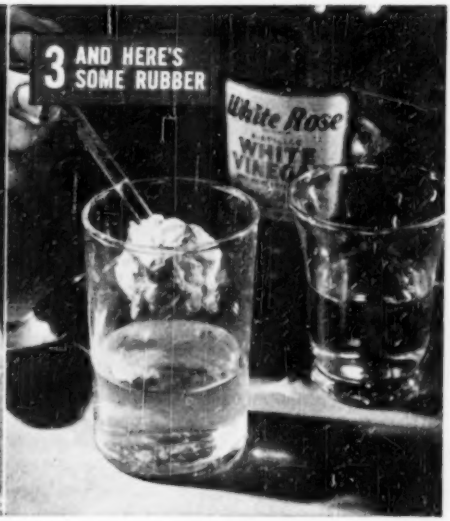
Squeeze your homemade rubber into a tight ball, and it will bounce. When it has dried, you can also rub out pencil marks with it. Joseph Priestley discovered this property in 1770 and immediately changed the mouth-filling East Indian word "caoutchouc" to "rubber," the term that has stuck ever since.

Rubber cement is made by dissolving raw rubber in a solvent such as benzol, gasoline, or benzine. You can make a usable sample by breaking your ball into bits and dissolving these in any of the solvents mentioned. (Lighter fluid, which is usually benzine, will do a good job.) Add the solvent slowly, until the particles have completely dissolved and the resulting cement is of the right consistency. To prove its strength, cement two sheets of paper together.

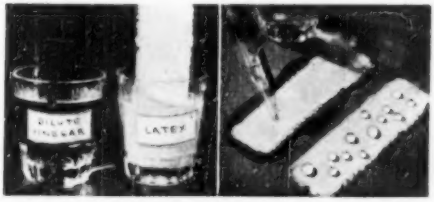


Waterproof textiles and yarns are often produced by coagulating latex right in the material. To demonstrate how this is done, put some latex in one small glass and



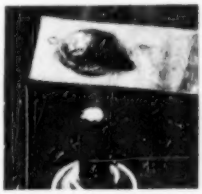


a solution of 1 part vinegar to 3 parts water in another. Soak a strip of clean cotton cloth in the vinegar, dry off the surplus solution, and then dip the cloth in the latex. A layer

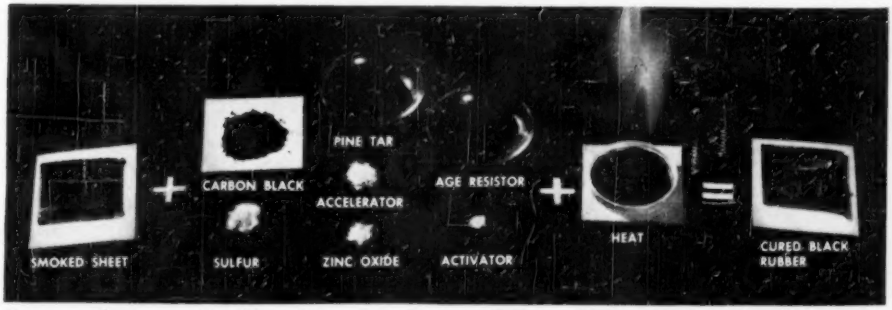


of rubber (that becomes thicker the longer it is immersed) will be precipitated on each side of the strip. Once the strip is dry, water will roll off the strip as it does off a raincoat, instead of soaking right through it.

Nearly everything we think of as rubber is really a compound of many ingredients that has been vulcanized—treated with heat. The added ingredients, plus heat, make rubber compounds hard or soft, add toughness, and control the color. The effects of vulcanization are easily demonstrated.



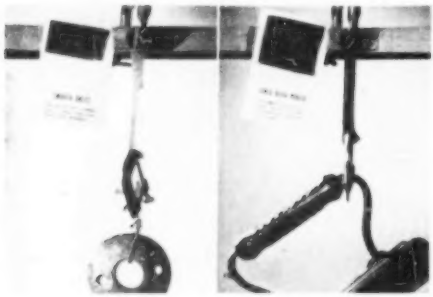
One difference between raw and vulcanized rubber is the comparative resistance to heat. Put a square of smoked sheet on a strip of tin. When the tin is heated, as shown in photo above, the rubber will melt and begin to decompose



From crude to cured rubber. Many ingredients go into common rubber products. This photographic chart shows typical chemicals needed to change "smoked sheet" from the plantation into rubber suitable for tough tire treads. The heating step is called vulcanizing.

amid smoke. A square of cured rubber, heated to the same temperature, merely curls slightly.

Another difference can be shown by cut-



ting strips of the same dimension from samples in your kit. Clamp one end of each strip to the edge of a table or board and hang a weight from the other. Smoked sheet begins to weaken and tear under a pull of only eight ounces. Cured rubber supports an eight-pound flatiron easily.

Foam rubber is made by adding sulfur and other ingredients to concentrated latex and beating air into it in a giant mixer. The fluffy mixture is then poured into molds and vulcanized. This method produces a cell structure that is interconnected. You can demonstrate this structure by blowing out a candle through the foam-rubber sample that comes with your kit.

Why tires heat up when speeding over the road can be shown by stretching a rubber strip and quickly touching it to your lips. The strip will feel warm. Release it suddenly, and it will feel cool. Rubber heats up when stretched because tension strains its molecules. It gives up its heat when the strain is released. Driving stretches tires, building up heat faster than it can be dissipated. END

These Miniature Merry-Go-Rounds Run Throughout the Winter

After running a merry-go-round for five years, Charles Hutchens, of Bell Gardens, Calif., built one of his own. The little model shown above measures three feet in diameter, is 21 inches high. Dime-store cowboys and Indians chase each other as the machine goes 'round and 'round. An electric motor turns the carrousel at 12½ r.p.m.

An old wind-up phonograph can keep the kids amused with more than music. Here one is being used to spin a miniature merry-go-round. Carl G. Erich, of Abilene, Kans., built the carrousel and hand-carved the horses and chariots. The animals rise and dip as they whirl around. Christmas-tree lights circle the dome.

Your Tires Will Last Longer...

IF you consider the weather. Keeping them at the right pressure is more difficult in winter because of the changes in temperature which they undergo when you move from warm garages to cold streets.

An increase or decrease of 8.5° in temperature can change tire pressure one pound. Hence, if you should check them in a garage where the temperature is 70°, then drive out into subzero weather, they would be seriously underinflated.

How seriously? Figure it out: 70 divided by 8.5 is about 8. Tires inflated to 24 lb. would lose 8 lb., and be underinflated 33⅓ percent in this case.

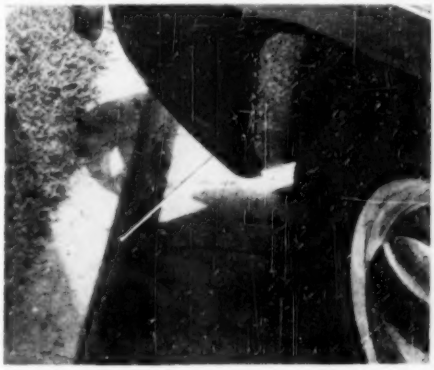
IF you check them often. It's a good idea to do it once a week, and to use the same gauge each time because gauges at different garages may vary considerably. Do your checking only after the tires have cooled to atmospheric temperature. And be careful not to lose the valve caps; they help prevent air loss if a valve happens to leak slightly.

IF you mount them correctly. The factory usually puts a mark on the sidewall near the bead, denoting the light point of the casing. Since the valve stem is the heavy point of the tube, it should always be placed opposite this mark. An out-of-balance tire wears more rapidly. If necessary, have the wheels balanced.

IF your car is okay. Improper caster, camber, and toe-in all leave their own individual marks on the front tires. Keep tabs on your tires for such signs and have the front wheel alignment checked at intervals. Also keep brakes evenly adjusted, or one tire will leave a thin trail of rubber every time you stop fast.

IF you rotate them regularly at 3,000- or 4,000-mile intervals. To avoid having more than one wheel jacked up at a time, put on the spare first. Follow through as shown. Inspect tires frequently, too, for cuts and bits of glass or tacks embedded in the rubber. Whenever they're smeared with oil or grease, wipe it off.

IF you drive carefully. Don't bump or scrape the curb, for this damages the casing. A pair of curb feelers will help prevent such damage. In diagonal parking, nose into curb slowly. Turn corners at moderate speeds so the tires won't slide on the pavement, and remember that fast starts and sudden stops wear out rubber.



Homemade Hunting Knife Saws and Cuts

HERE'S an all-around hunting knife that you can make from an old power hacksaw blade. Besides the razor-sharp cutting edge, the opposite edge has teeth that will saw through bones, saw a crotched limb for your fishing-pole rest, or scale fish. The notch will open bottles.

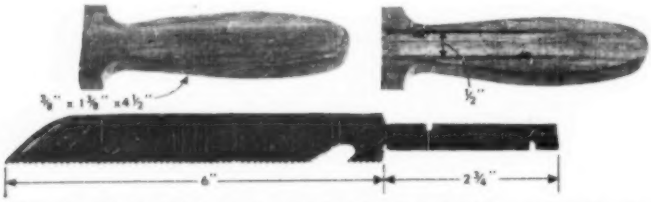
Construction is simple and it's not necessary to remove the temper from the saw blade to make handle fastenings. Cut off the end of an old hacksaw blade to make your knife blade. The teeth at the end of a hacksaw blade usually are in pretty good condition since they don't get much use.

I shaped the blade on a cutoff wheel, making it 6" long with a shank ½" wide and 2¾" long. When you sharpen the back of the blade, you can get a factory-like edge by using a simple sliding jig to pass the edge across the grinding wheel. However, you can grind it freehand if you're careful.

In making the handle, use two ⅜" by 1⅜" by 4½" hardwood blocks. Cut the blind groove in one block just deep enough to take the shank of the handle. After grinding two small notches in the shank, lay the shank in the slot and drive a nail into each notch and into the grooved part of the handle. Snip off the nail heads as close to the shank as possible. This will leave the nails extending about ⅛" above the surface of the grooved half of the handle.

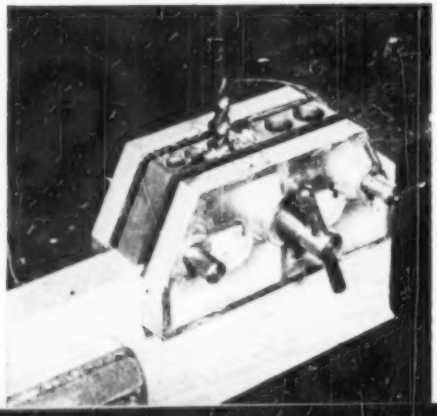
Place the shank in the groove, apply waterproof glue to both halves of the handle, and clamp them together until the glue sets. Then you're ready to shape the handle to a comfortable grip with rasp and sandpaper.—*W. G. Waggoner, Sacramento, Calif.*

One edge of this hunting knife still has the teeth of the power hacksaw blade from which it was made. Other edge has been sharpened.

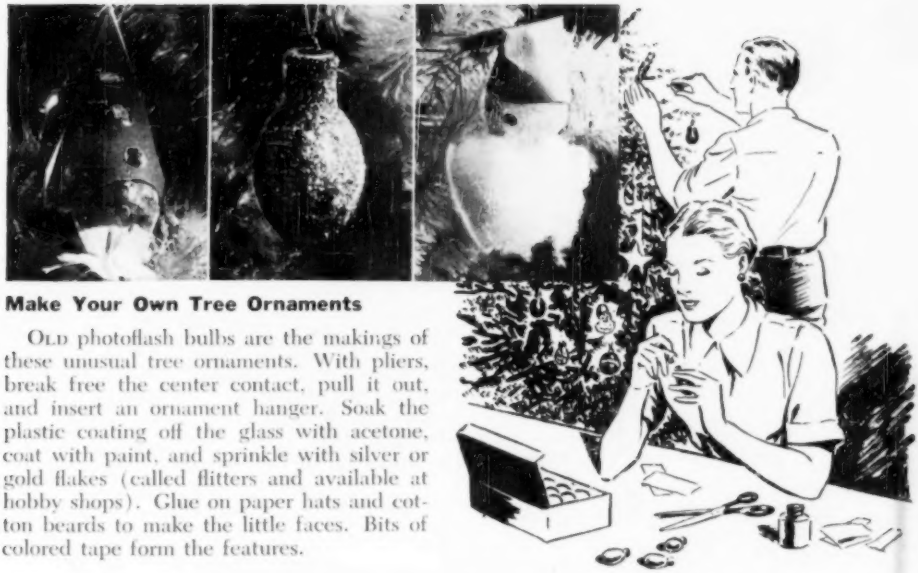


Only critical dimension is groove in one half of handle. It must be exactly deep enough and exactly wide enough for shank of blade. Otherwise, blade will wobble in handle.

Jig Guides Bit to Insure Perfect Alignment of Dowel Holes



You can bore dowel holes square and dead center on the thickness of the work when you use the jig at left. The screw has right-hand threads on one end and left-hand threads on the other end. When you turn the handle clockwise, the jaws are drawn together to exert equal pressure and center the middle member, with the bit guides, on the work. The jig takes five bit sizes: ¼", 5/16", ⅜", 7/16", and ½". It's made by the Dowl-it Co., of Hastings, Mich.



Make Your Own Tree Ornaments

OLD photoflash bulbs are the makings of these unusual tree ornaments. With pliers, break free the center contact, pull it out, and insert an ornament hanger. Soak the plastic coating off the glass with acetone, coat with paint, and sprinkle with silver or gold flakes (called flitters and available at hobby shops). Glue on paper hats and cotton beards to make the little faces. Bits of colored tape form the features.

My Most Ingenious Solution

While driving along a lonely country road one night, I was stuck with a flat and no light to work by while I changed tires. But while stumbling around in the darkness I stumbled over something that made an excellent emergency light. What do you think it was?

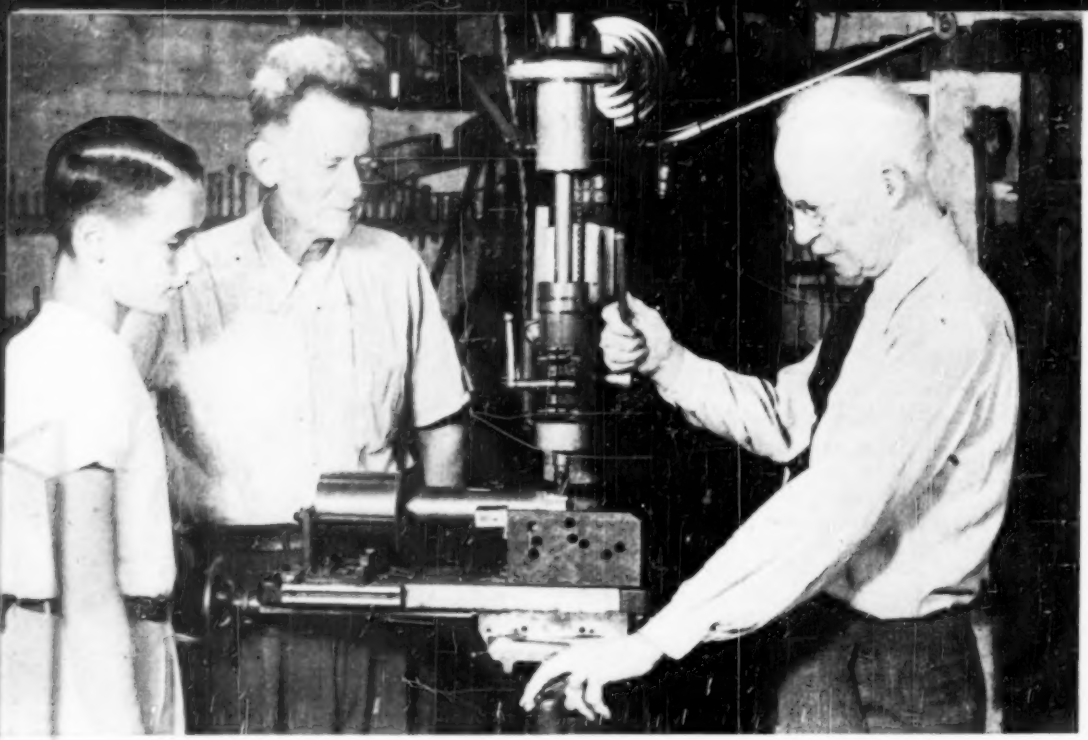
The thing I tripped over was an old clay brick. I syphoned gasoline from the tank, soaked the brick in the gas and lighted it. The brick absorbed enough gas to keep burning until I changed the tire.—Harry E. Vendryes, Jr., Jamaica, B.W.I.

Simple Way to Unstick Glasses

WHEN two glasses or bowls stick together, put a few ice cubes in the top one and set the bottom one in hot water. Let them stand a few minutes and they'll come apart easily.—*M. McLees, Moose Jaw, Sask.*

A Wet Sock Snares Radiator Dust

DRAW a wet sock over the bristles of a radiator brush before use. It will clean between the pipes more effectively and won't cause the dust to fly about as dry brushing will.—*R. M. Woodbury, Haverhill, Mass.*



Teamwork paid off in production when Charles A. Trask, a retired engineer, began doing defense work in his basement shop in 1942. Soon swamped with jobs, he recruited neighbors and high-school boys, training them himself. Now 83, Trask is again helping Uncle Sam re-arm. Here he shows two friends in his shop how to work a small vertical milling machine. That thing he's making is an adapter sleeve for a 30-ton horizontal boring mill.

Can You Help America Arm?

Home shops can turn out thousands of items that Uncle Sam needs right now.

By Ray Millholland

Formerly Chief of Technical Unit, War Production Board

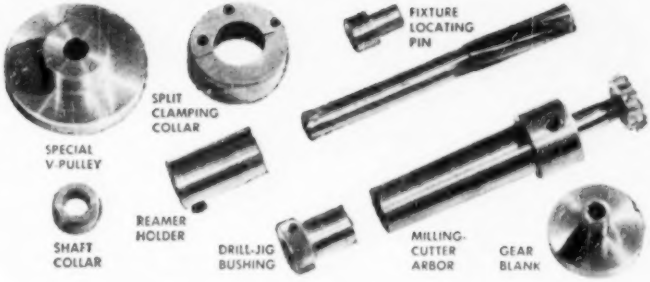
AMERICAN industry can re-arm our country and our allies faster and more economically if every suitable tool is put to work. There are many such tools in home workshops. They helped to win World War II, and they can help again now.

A production-wise Yankee mechanic, for example, refused to sit out the war against Germany and Japan in his rocking chair and converted his back-yard shed in New England into a precision shop for making machine-gun bullet dies. This is one of the toughest production problems for the big shops, but this veteran of the lathe and bench proceeded to take the headache out of making bullet dies. He originated a method that he taught to unskilled men in a few hours.

Where to Find Work

That's just a sample of what can be done. Literally thousands of the items needed now can be made in a home workshop equipped only with a screw-cutting bench lathe. Tool-and-die shops searching in vain for highly skilled toolmakers have many rough-turning jobs that can be done very well by amateurs, thus saving the more skilled men for the final, precision-finishing operations.

Characteristic of these rough-turning jobs



Any of these parts can be turned out on the sort of bench lathe found in many home shops. A drill press is a handy auxiliary for drilling and tapping the various holes.

are plug-gauge blanks, drill bushings and liners, special screws, handles, locating pins, special lathe-arbor blanks, special reamer and round broach blanks, and ring-gauge blanks. Roughing out these vital items requires more time than the final precision sizing, and many harassed tool-and-die-shop owners will welcome a workshopper's help.

The production shops that are working directly on defense jobs, either as contractors or subcontractors, frequently have rough-turning tool jobs coming up. These shops will also need small replacement parts for their machine tools. A cam roller will wear out, a special screw break, or a bronze bearing fail, and have to be replaced at the earliest possible moment.

Small repair parts--mostly lathe jobs--would have to be made in the production plant's toolroom. So you may make a friend for life by letting the toolroom foreman know you have a sturdy little screw-cutting bench lathe in your basement and are available evenings for "emergency operations."

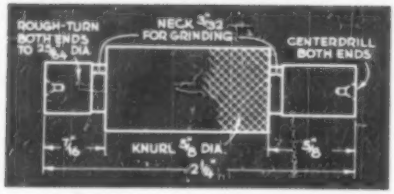
Home-workshop operators who do not live in industrial areas can do other kinds of emergency work. Farmers are likely to need repair parts for their machinery. Refrigerator units and domestic appliances sometimes need a new bushing—in a hurry Men who ordinarily do their own work may be working overtime elsewhere. And in a few minutes on a lathe a standard part for one kind of equipment often can be altered to keep some other kind of equipment running.

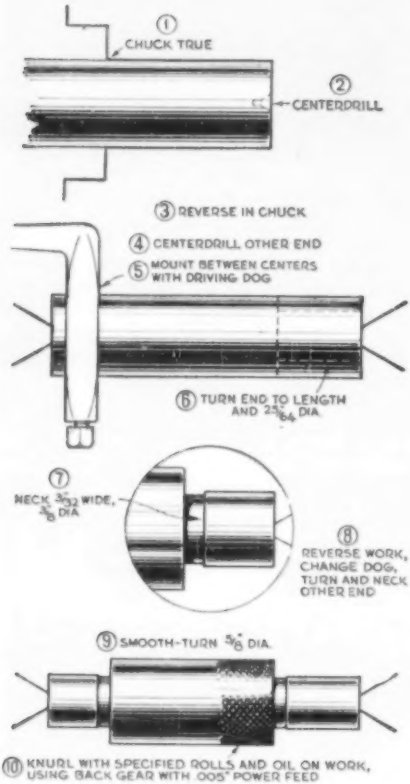
How Organization Counts

Pooling facilities as well as manpower multiplies the effectiveness of the small shop. One member of the pool may be able to contribute, besides his time, a more suitable workplace than his associates. The others then can move their readily portable lathes, drill presses, bench milling machines, small shapers, and power hacksaws into his shop. All hands contribute odd bits of material, drills, taps, reamers, micrometers, and other small tools to the pool—and in a matter of hours a small but well-equipped machine shop has sprung up!

In the 1940's a retired mechanical engineer, who converted his basement shop into a very effective defense production unit, soon found that one man could not keep a pair of screw-cutting lathes, a small milling machine, and a 7-inch shaper working to capacity So he scoured the neighborhood for help and found several elderly, retired men who were more than anxious to do their part. He also enlisted some husky high-school boys. The retired engineer supplied the know-how—and by the end of the war his little basement machine shop was an important auxiliary source of supply for the

The drill jig and hand-scraped angle plate at right were produced by basement shops mentioned in this article. The other pieces are typical milling-machine or shaper jobs.





Thousands of small plug gauges are needed in mass production. Their working life is short and they must be replaced. Here's how they might be rough-turned in a home shop, ready for a tool-maker to grind to size and heat-treat.

toolrooms of more than a dozen large plants.

Nearly every man who is seriously interested, to the extent of putting his hard-earned money into a small metal-working lathe, already has mastered the fundamentals of its operation. From there on it is a question of developing accuracy—and *speed*.

Accuracy Is a Must

Even the "rough-out" jobs that the home workshop machinist produces must be made to reasonably close dimensions. He must turn out a piece with enough stock left on the "close" dimensions so that the highly skilled toolmaker, who takes over from there, can finish it quickly. The customer usually specifies on his blueprint or sketch how much "finishing stock" to leave on.

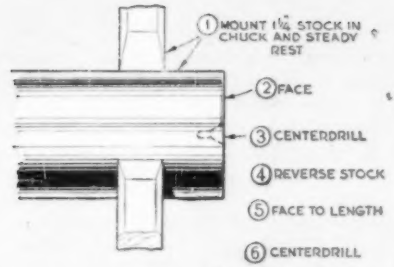
Holes are usually bored five to twenty-five thousandths of an inch undersize, to allow for final grinding or reaming. Usually, tool shops like to have the rough-turned diameters run from twenty to thirty thousandths oversize. If the individual customer wants more or less stock left on a specific job, he will issue specific instructions on that point. The same applies to the over-all length of the piece and the distance from the end to the various shoulders on, say, a multiple-diameter rough-turned shaft.

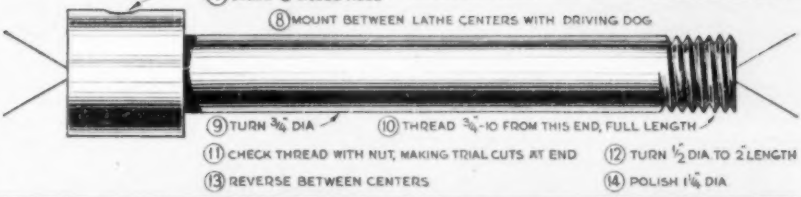
On these "roughing-out" operations finish is unimportant; so don't spend any time filing and polishing a surface that the toolmaker is going to remove later. A set of from one- to three-inch micrometers is valuable for doing even roughing-out operations, but an acceptable job can be done with only inside and outside calipers, a first-quality machinist's steel scale, and a magnifying glass.

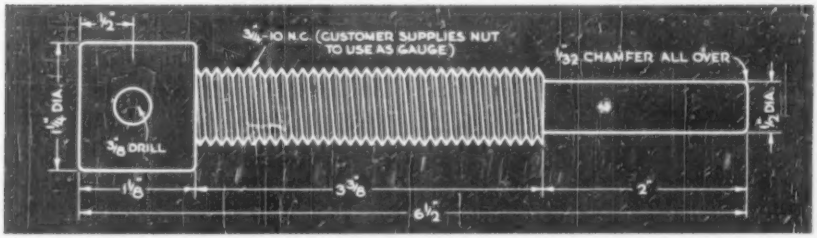
Leave Enough Stock

There is only one unforgivable sin in the "roughing-out" operations—not leaving the toolmaker enough stock, in the holes, on the outside diameters, and at the shoulder lengths, to "clean up the job."

If the piece is a roughed-out drill bushing, it is highly important that the hole be concentric with the outside diameters. When bushings are made from high-priced material, the rough blank often is furnished with only enough stock at the ends for a light rough and finish cut. In such a case, the rough blank is first chucked and the hole bored out, leaving the specified amount of stock for final finishing, to be done by the toolmaker later. Then the piece is placed on a soft steel arbor that runs "dead true," and

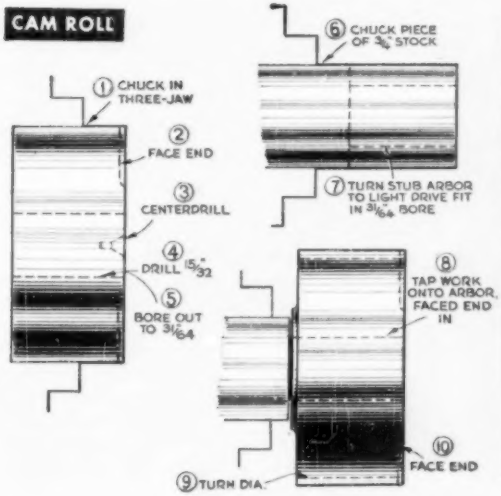


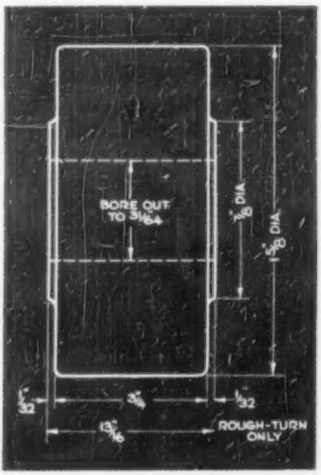


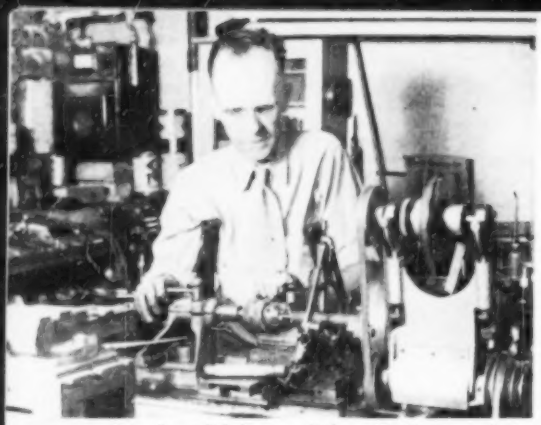


Typical of rush jobs is this special screw, the lack of which might knock a machine out of the production line. It's a simple chore for any workshopper who has mastered the technique of threading in the lathe.

Automatic machines of all kinds require many cam rolls and roll pins. Making replacements for these is one of the nuisance jobs that tie up toolrooms and skilled toolmakers, yet could be handled by the home-shop machinist.







Crutches didn't stop Robert T. Perine, of Indianapolis, from turning out a wide variety of jigs and fixtures during World War II. Here he's centering stock to turn a replacement for the scored 1" lathe arbor lying on the cross slide. The stock, chucked at one end, is supported in the steady rest. His old customers are now looking Perine up again.

the outside turned to size between centers.

An even quicker way is to chuck a piece of scrap steel in the lathe, turn it down so that the bushing can be driven on with a few light taps of a block of wood, and turn the outside in this manner. The need for concentricity between the hole and the outside diameter is obvious, for if the outside does not run true with the hole, there will not be enough stock left on it for finishing.

Next to his trusty little lathe, the home workshop defense worker needs a good handbook. Two of the standard handbooks are *American Machinists' Handbook and Dictionary of Shop Terms*, published by McGraw-Hill Book Company, New York; and *Machinery's Handbook*, published by The Industrial Press, New York. These are books that designers and machine shops use when making drawings of tools and standard parts.

In most instances—especially with tool shops—the customer is in a better position to supply the material he specifies for the job than the home-workshop operator. So make it the rule to have the material furnished.

Under no circumstances, if you spoil a piece of material furnished by a tool shop or defense plant, should you try to cover up your mistake by making a duplicate piece from your own material! Such ersatz won't take heat treatment properly.

How Much to Charge

Many tool shops are willing to pass out subcontracts on a "time and material basis." They furnish the material and you turn in an honest report of the time you spent on the job, the pay ranging between $2 and $3 an hour. When you are cutting your eyeteeth on this sort of work, let the customer fix the rate of payment for the first few jobs. If he "plays you for a sucker," you can charge it off to experience, and use the information thus gained in estimating your costs for the next customer. Before long you'll be able to look at a simple drawing of a small part and tell offhand, within 10 percent, how long it will take you to make it.

Give Your Customers Service

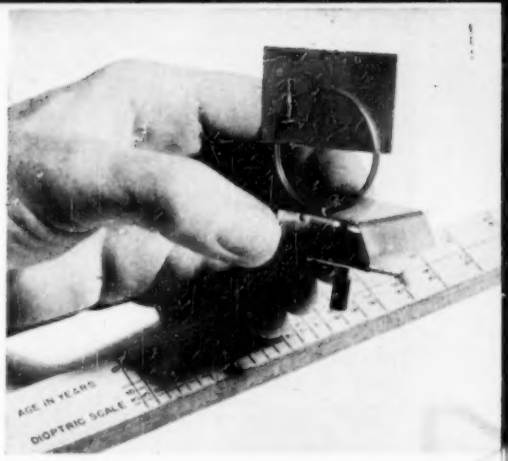
Nearly every busy tool shop and manufacturing plant would like to find another reliable source of supply that is open for business every working day—even if it is only from six to ten, evenings. The customer also wants a telephone number that he can call during regular business hours where some one is always available to relay a message to you. *Always answer these calls*, either by telephone or by personal visit, as soon as you can.

If you explain to your customers that giving them pickup and delivery service will cut into your limited productive time, some may arrange to have their truck deliver the raw material and work orders and pick up the finished work. Provide a box for each customer, so that you can place his finished work in it, along with his blueprints and any special tools he supplied for the job—such as a knurling tool, for instance—which his trucker can call for and pick up while you are absent from your basement shop during the day. This same box, by the way, offers an inviting convenience to the customer—into which he can put the material and blueprints for the next job.

Where to Start

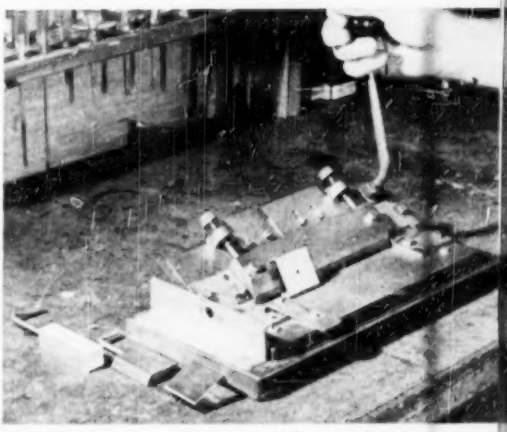
The newspaper advertisements for skilled toolmakers and machinists will indicate which shops in your vicinity need the sort of part-time service you have to offer. A place that operates any sort of power-driven machinery needs small repair jobs done. Local garages and service stations need armatures turned down. Plumbing shops often need some work done, such as facing and drilling a pipe flange to fit a special job. As a matter of fact, the problem for the home-workshop operator, in these hectic times, is not one of finding customers so much as being careful not to get swamped with rush jobs. END

Case History of a Basement Defense Project



WHEN the U. S. Navy needed slides for its Link eye testers, three Ridgewood, N. J., men turned out 1,500 of them in a basement home shop. Working nights after a day-long stint in a defense plant, Floyd McGuckin, with his father John J. and his brother Lloyd, devised the semi-production methods shown in these photos.

The slide had to fit a wooden scale and carry a card at the top and a big map pin at one side. To prevent bending of the pin when the device was packed, the McGuckins made it telescope into a piece of tubing. The card holders were made by winding stainless-steel wire on a mandrel in the lathe, and cutting every two turns apart. A retaining clip soldered over the ends held the ring on the slide. A tiny handle was affixed by a single screw through one side of the housing. Form turning tools in a tool-post turret shaped and cut off the handles at one chucking. To tighten the screw, a special offset screwdriver had to be made. END



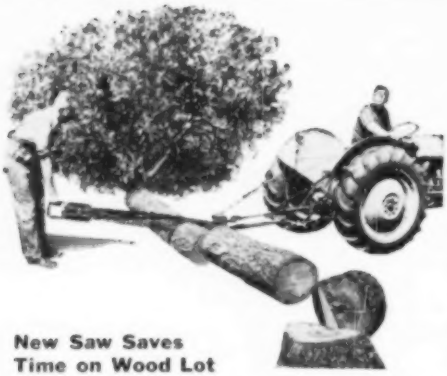
Housing was bent from a stainless-steel strip, first punched for the handle screw. Three bends were then made on a homemade brake. The piece was closed over a steel bending form (in foreground) and a hole drilled for the rivet.

A flat spring in slide provided friction and kept it parallel to the scale. The spring ends were inserted in a slot and bent up. Rivet hole was punched and slipped on pin in the jig shown, where a square punch shaped the center for proper tension.

Short brass rivets were cut from wire in a jiffy on this gadget—two steel blocks aligned by loose pins, with mating grooves that formed a channel for the wire. The notched, hardened cutter bar was pivoted on a screw. Wire was fed from the bottom.

Housing sides were riveted together with the spring inside. Then a recessed dimple for the handle retaining screw was formed with this anvil and punch. The conical anvil was turned on the end of a screw and threaded into the flat base plate.

Tiny piece of tubing in which the map pin slid was held on for soldering by an adjustable clip made from a fiber block and a spring strip, as at right.



New Saw Saves Time on Wood Lot

THIS chain saw fits the power take-off of any tractor or jeep. It notches, fells, and bucks fast, and is said to handle four-foot logs or small limbs with equal ease. Design of the chain assures ample sawdust-carrying capacity. A safety clutch protects saw and operator, disengaging the saw if it is pinched or encounters an obstruction. Von Ruden Mfg. Co., Claremont, Minn., makes it.

Tip for Christmas Tree Safety

CHRISTMAS trees are less of a fire hazard if sprayed with a solution made of 9 oz. borax and 4 oz. boric acid in a gallon of water. Other inflammable Christmas decorations can be dipped in the same solution.

My Most Ingenious Solution

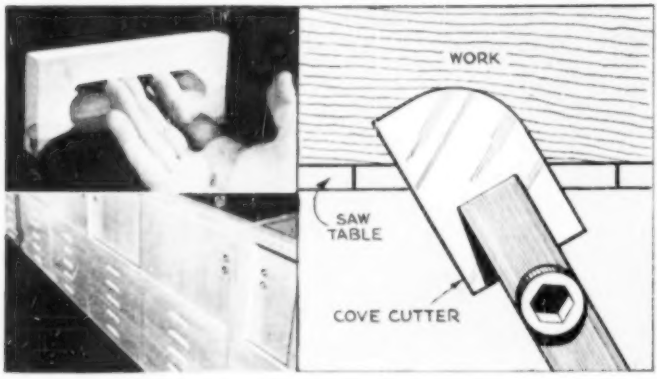
I needed gas to wash engine parts. Instead of getting a mouthful of gas when I syphoned it from the tank, I got the gas where it belonged—in the bucket. What do you think I did?

On the end of a wire, I tied a wad of rags. I pushed the wire down the hose until the rags were in the gas in the tank. Then I yanked the wire and wad out. That pulled the air out of the hose and the gas followed.—Ralph Wyant, Indianapolis, Ind.

How to Cut Recessed Drawer Pulls on a Circular Saw

RECESSED drawer pulls eliminate the need of extra hardware, make finishing easier, and have a clean, modern look that's especially good with built-in cabinets. Though making them by hand would be laborious, they can be cut in a moment on any standard circular saw.

Replace the blade with a molding head carrying ½" cove cutters. Cut a blank table insert of ½" plywood and fit it in place, using wedges if necessary to get a tight fit. Tilt the table or arbor 45°, check to be sure the lowered cutters are clear, and start the motor. Then raise the arbor (or lower the table) until the blades cut their way through the new insert and project about ¾" above. Count the exact number of handwheel turns needed to raise the cutters ¾". Use the fence and clamped-on stop blocks to locate the drawer front just the right place.



Now you're ready to cut the recessed pull. With the cutters below the surface and the work in place, start the motor, turn the handwheel the measured number of times, and lower the cutters again before lifting off the finished piece. The method is suggested by the Jet Tool Co., of San Diego, which makes molding heads and cutters.

It's a midget, about midway in size between an airbrush and ordinary spray gun, but this sprayer will serve you well. Designed and made by Walter E. Burton, of Akron, Ohio, it handles well-thinned lacquer, enamel, model-airplane dope, and other liquids.

A Homemade Sprayer Does Touch-up Jobs

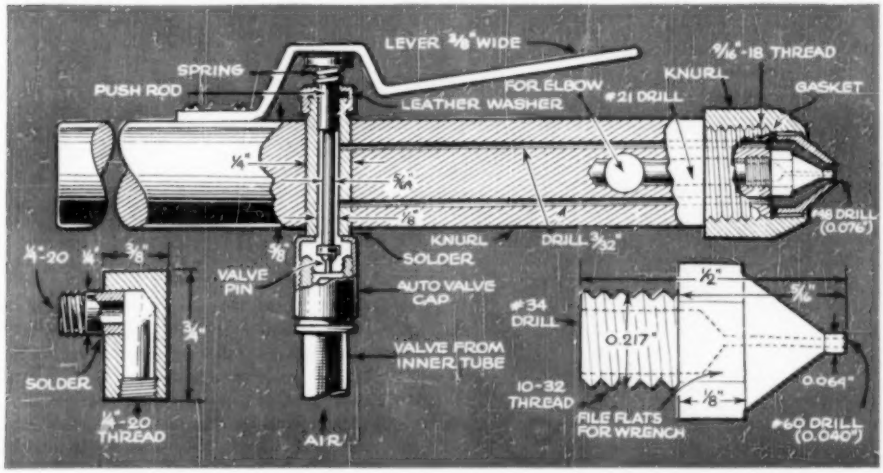
A VALVE from an old inner tube controls the air flow in this little spray gun, a homemade tool that you will find handy for many small painting jobs. To work it, you press a lever. This depresses a pushrod, opening the valve. Air escaping from the nozzle creates suction that draws out paint.

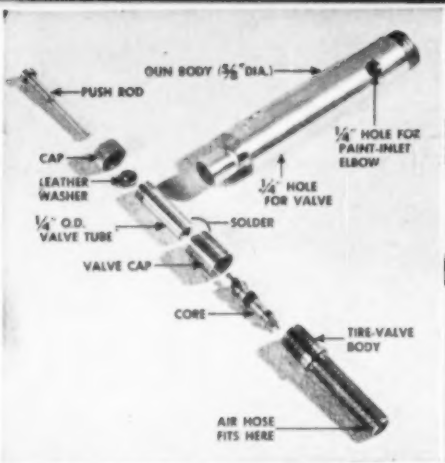
The valve assembly. Cut the tip from the tire-valve cap (if it's the kind that has a core-screwing tip) and drill a ⅛" hole through the top. Convert a ⅞" piece of ¼" rod into a tube by drilling a ⅛" hole lengthwise. Thread one end for a screw cap. Silver-solder the other to the tire-valve cap.

Turn a pushrod from ¼" rod, making the upper end a sliding fit in the ⅛" tube. For most of its length, however, turn down the pushrod to 5/64" diameter. An oiled leather washer under the top cap keeps air from escaping.

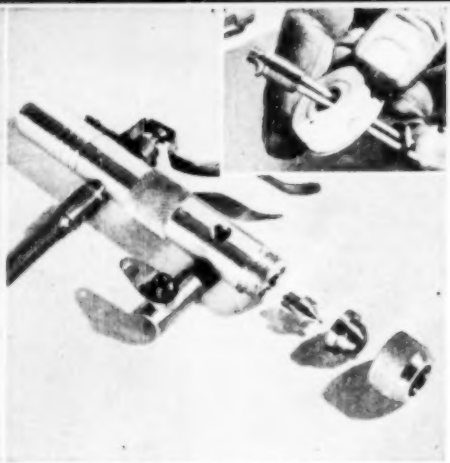
Making the body. Use a 4" or 5" length of ⅜" aluminum or brass rod. About 2½" from the nozzle end, drill a scant ¼" hole crosswise for the valve tube. With the tube press-fitted in place, drill two 3/32" lengthwise holes into the tube from the nozzle end of the body.

To carry paint to the nozzle, center a hole in the end of the body, using a No. 21 drill. Tap this 10-32 for the paint tip. Drill a ¼" hole at right angles into this lengthwise hole





Here are the valve parts. Gun body (upper right) was made in two pieces because longer stock was lacking. An extension, not shown, was driven on shoulder turned on the piece above.



Nozzle parts are adjusted by trial. Piece of brass soldered on inlet elbow hooks over pin on gun to keep elbow from turning. Nut clamps tube (inset) to jar cap, which has air-intake hole.

and tap it ¼"-20 for the paint-inlet elbow.

The nozzle assembly. It's best to make all three parts of brass. Critical dimensions are given in the drawing. The paint-delivery tip can be turned from ¼" rod. The relationship between air and paint openings can best be adjusted by trial.

Attaching the paint jar. Make an elbow from two pieces of brass as shown in the drawing. Any small jar with a screw cap can be used. Fit a length of ¼" o.d. brass tubing through the cap and thread the upper end to fit the elbow. Push a brass flange over the tubing and solder it in position. A nut turned up from below will then clamp the tube to the jar cap. Punch a small air hole in the lid.

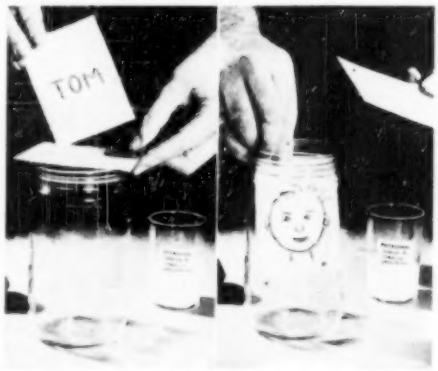
The gun should operate well on 20-pound air pressure. The spray characteristics will depend largely on the position of the outer air shell in relation to the inner paint tip. If the gun fails to spray, the gasket that regulates the position of the air shell may be either too thick or too thin. END

Simple Chemical Magic Changes Name to Caricature

Using only ordinary ink, starch, laundry bleach, and two common drugstore chemicals, you can baffle your friends with this amazing stunt of presto-chango. The name of a person is written on a piece of paper, which is then inserted in a glass jar. There—before everyone's eyes—his name disappears and his caricature takes its place.

The trick requires preparation, naturally. First draw the caricature in invisible ink that is made by mixing a pinch of potassium iodide and a pinch of cornstarch in a tablespoonful of water, and heating for several minutes to dissolve the starch. When you write the name, use any ink that can be removed with ordinary ink remover, and dilute it 1 part ink to 15 parts water.

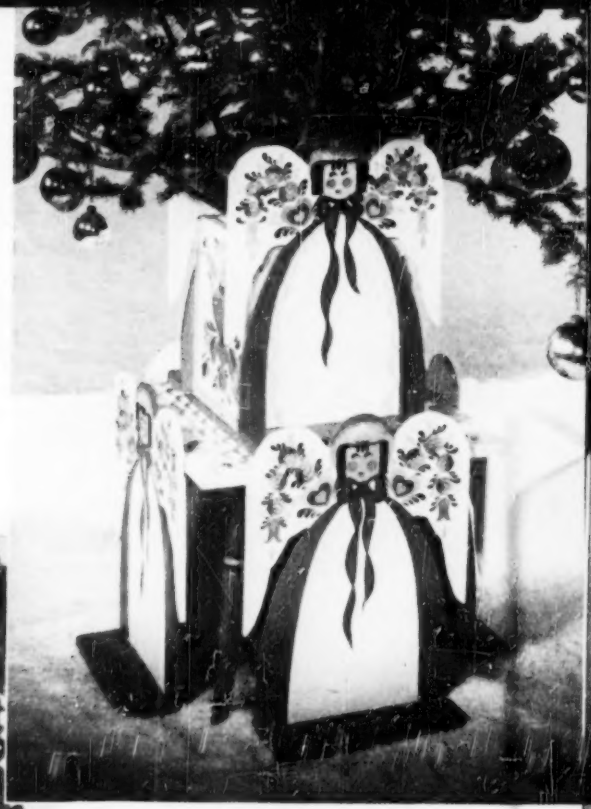
It is a whiff of chlorine gas in the jar that does it. It bleaches the ordinary ink and releases the brown-colored free iodine in the invisible ink. You can make the small amount of chlorine needed right in the jar. Just cover the bottom with sodium hypochlorite bleach (laundry aids such as Clorox



or Dazzle), and then add a little hydrochloric acid. You can get a few cents' worth of this, as well as the potassium iodide, at the corner drugstore. Handle the acid carefully, add it slowly, and don't inhale the irritating gas that fills the jar. A stiff card over the top will close the jar.—*Kenneth M. Swezey, Brooklyn, N. Y.*

Here's a Novel Way to Give Your Christmas Tree a Lift

THIS year use a gaily decorated stand to add to the glamour of your tree. To make the base, cut down the legs of a table or stool, and use a small wooden box for the upper tier. Nail crosspieces to the bottom of the tree trunk, stand the tree in the box, and pack it with sand. The jigsawed cutouts can be hand-painted or enlivened with holiday decals. The wistful angels pictured at the right are the work of Peter Hunt. The upper tier alone will easily hold a small table-top tree.



Here's a Make-Believe Yule Tree That You Can Hang on a Closet Door

IF YOU haven't space for the traditional holiday tree, you can have one on a door or wall. The jigsawed job at the left is another Peter Hunt folk design. It was cut from a piece of plywood. Any large half-round form such as an old table leg or a newel post sawed through the middle can be used as a base. Old chair legs and spindles or stair balusters serve nicely for the angels. Cut them to size and tack on plywood wings. Use drawer pulls with a hole drilled at the center for the candleholders.

And Here's How to Make a Shop Tree

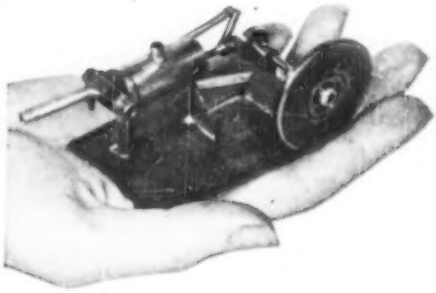
WANT real Christmas atmosphere for a shop party? Take a tip from the machine-shop staff of the Atomic Energy Commission's New York Operations. They made the tree at right from four plywood cutouts, trimmed it with a fancy collection of gears, wheels, stampings, small tools, and scrap. Lathe shavings supplied the icing, and burned-out fluorescent lamps were used to make the candles.

Scraps and Solder Become an Engine

IT'S ALWAYS a thrill to build something that *runs*. This little steam engine has plenty of zip and an eye-catching valve action. Hooked to a toy boiler, bicycle pump, air tank, or carbon-dioxide cylinder, it will run a model or a midget electric generator with enthusiasm.

So long as you use only air, CO_2, or low-pressure steam, you can safely assemble the engine with soft solder, like the one shown. For hot steam, above 15 lb., better use silver solder.

The cylinder is brass tubing. Smooth the bore by wrapping very fine abrasive cloth around a rod and working it back and forth in the cylinder. If you can find another piece of tubing that is a good sliding fit in the bore, make the piston by soldering a disk on one end. Otherwise, turn aluminum or brass to a shakeless but free-running fit in the cylinder, turn two oil grooves, and drill in from an end to lighten the piece.



In just two evenings you can build this palm-sized power plant.

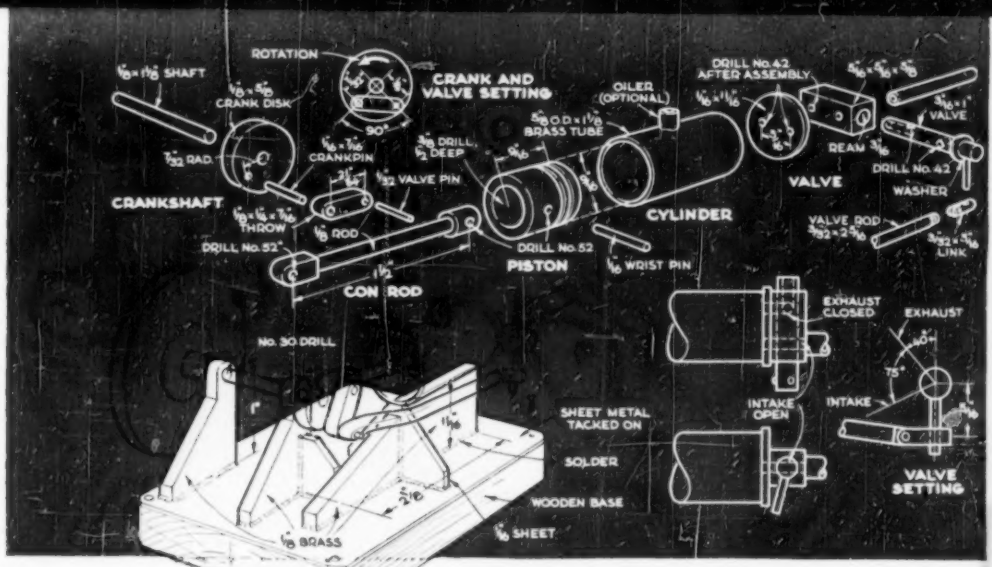
Cut a disk of sheet brass for the cylinder head, and a length of square or hex stock for the valve housing. Drill a No. 13 hole lengthwise through this for the oscillating valve. Spot two punch marks 5/16″ apart on a diameter of the disk. Then solder the disk to the cylinder and the valve housing to the disk, parallel to the punch marks.

Run a No. 42 drill from the open end of the cylinder into the punch marks to form the ports. The intake port runs right through the valve housing; the other just into the No. 13 hole.

Cut a piece of 3/16″ brass rod to length for the valve and solder a washer ¼″ from one end. Insert it in the valve housing after running a No. 12 drill or a 3/16″ reamer through. Then drill through the exhaust port half way into the valve. Rotate the valve 75° and drill the intake port through.

Remove the valve to drill a hole outside the washer, displaced 40° from the exhaust port, for the pin that carries the valve-rod link. Also drill a hole lengthwise from the other end to meet the exhaust port and open it to the air.

Solder a short piece of tubing over the intake port on the valve housing as a steam inlet. Then slip the valve into the housing, and carefully solder a second washer on the exhaust end to retain it.



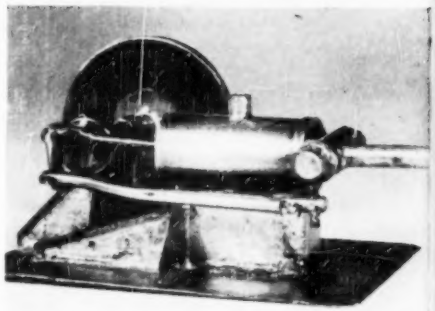
Bearings and the cylinder support can be sawed from ⅛″ brass, or bent up of sheet metal, with solid bearings soldered on. Solder the cylinder in place cautiously so as not to overheat and loosen the valve.

Drive the crankshaft into the crank disk, after you've drilled a No. 53 hole on a 7/32″ radius. In this, drive and solder a 1/16″ crankpin. Make the con rod by soldering or screwing endpieces onto a ⅛″ rod. Put the con rod on the crankpin before soldering on the outside throw. Position the throw to bring the valve pin 90° ahead of the crankpin and on a ¼″ radius.

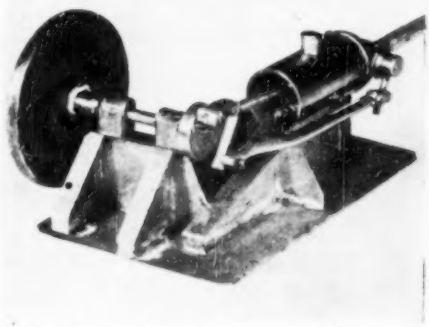
The flywheel shown was made by soldering a 1⅜″ steel washer onto a brass hub drilled a press fit on the crankshaft. If you can't get a flywheel from an old toy, you can cast one of lead or turn one from solid stock, a faucet handwheel, or the like.

The 3/32″ valve rod is about 2⅜″ long. Bend an offset in it as shown in the photos. Assemble it with 1/16″ pins and check the valve action. The ports should be wide open when the piston is midway on its stroke—that is, with the crankpin at the top or bottom of its circle. Some valve adjustment can be made by bending the valve rod to shorten it slightly. If the exhaust valve doesn't open all the way, a longer rod should be substituted.

If everything works freely, the engine should run on as little as 2 lb. pressure. A hole drilled halfway along the cylinder, with a bit of tubing soldered over it as an oil cup, keeps the piston lubricated—*W. M. Dierks, Chicago.*



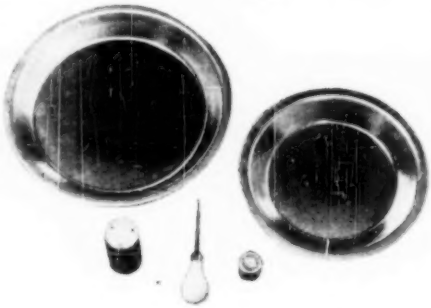
Rocker valve action is driven by an extra crank throw displaced 90° from connecting-rod crankpin. The inlet tube can be connected to a boiler or air source by rubber tubing.



Business end of engine shows solid bearings soldered onto supports bent up from sheet metal. The short tube on top of the cylinder is an oil cup for lubricating the piston.

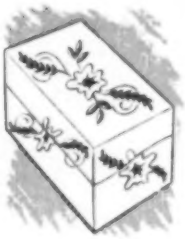
Last-Minute Gifts Anyone Can Make

IF YOU still have half your relatives unaccounted for on your Christmas list and you can't face the calendar without shuddering, here are some gifts that will fill a lot of empty stockings in a hurry. The dime-store parts are easy to come by and in a single evening you can add any one of these quickies to your bulging pack.



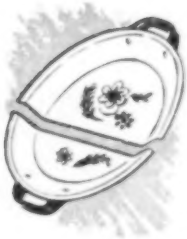
To make the two-tier tray shown in the photograph, find the centers of both pie pans. With a compass, draw a circle on the underside of the larger pan ½" smaller than the diameter of the wooden spacer—a cylinder of wood 3" long cut from a curtain rod or a closet pole. Punch three equally spaced holes within this circle. Cut the spacer ends perfectly square and invert the pan over one end, centering the three holes on it. Spot the holes through to the wood and drill and countersink them in the spacer. Drill a small, deep center hole in the opposite end of the spacer and punch a single center hole from the underside of the smaller pan.

Paint all parts and let them dry overnight. Screw the bottom pan to the spacer with flathead screws. Place the small pan over the single hole in the spacer, with the spool on top of it, and drive the awl in tightly to hold the whole assembly together. Add free-hand decorations or decals. END



Want to pep up the kitchen? This is purely a decorating job. Enamel a recipe file box white, trace on some handsome stencils and fill in with colors. Or enamel the box black, center a stylized initial and paint it and some surrounding scrollwork in gold.

Solder a hinge to two pie pans to make a silent butler. Add a pot-lid knob for lifting the cover. Hacksaw the end of a file handle to fit and attach to the lower pan with a wood screw. If a light frying pan is used for the bottom container, it supplies its own handle.



Cut a pie pan into two parts, slightly off center, and you have a crumb tray and shovel. Snip the rolled edges with heavy side-cutting pliers and cut across the tin with tin snips. File the edges smooth, enamel, and decorate. Attach colorful plastic cabinet handles.

Every family has one ardent horticulturist. Please yours with this window-sill planter, made by decorating a 4½" by 13" bread pan or cake-loaf tin. Before planting, fill the tin with an inch-high layer of pieces from a broken clay flowerpot. This will allow drainage.

For Future Generals

These clothespin troops maneuver with a realistic wooden tank and a field gun.

By Herbert Pfister

PS STAFF PHOTOS

DEPLOY this toy task force under the tree on Christmas morning and watch your boy's eyes light up.

The troops, the tank, and the field gun look like those that the children have seen in parades. There are soldiers, sailors, and marines—even an admiral—in this unified nursery defense force.

And the big feature is simple construction. Your scrap box will furnish the main parts of the tank. The troops are made of clothespins, washers, and tacks. Two pieces of wood and wheels from an old toy make the field gun. Its barrel is the tube of an old percolator. All the toys can be cut to shape and put together with your hand tools. Turn the page to see how you can make them.

The tank: Here's what you'll need:

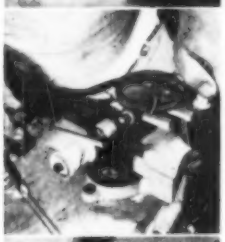
15" of 2" by 3" pine.
½" plywood 2½" by 9½".
2 pieces of ½" pine 1⅞" by 2¼" for small turrets.
2 ¼" dowels 1½" long.
½" dowel 6" long.
14 thread spools 1¼" by 1½".
12 squarehead lag screws ¼" by 2½".
1 squarehead machine bolt ¼" by 6".
2 screw eyes.
2 upholstery tacks.
2 sticker stars.
rubber floor matting.

Chisel removes wood to form slot across one end of two-by-three body. First make two saw cuts to form sides of slot. Use of slot is shown in photo at bottom of this page.

Plane smooths angled ends on underside of two-by-three body. Angles can be sawed to shape first when two-by-three is locked in vise. Job could be done with sandpaper.

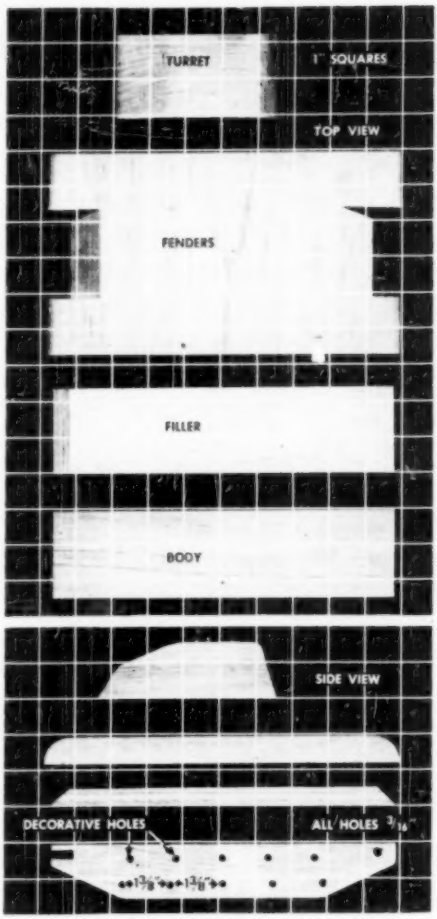
Saw cuts outline waste to be removed at each end of fender piece. This is done after fenders, filler, and body are assembled. Then chisel out waste between saw cuts.

Rasp then lines up angles at each end of fenders with angle already sawed in ends of filler. File will do job, but is slower. This is top view before turret was mounted.



File squares up shoulders at the ends of a spool. Otherwise the shoulders would cause treads to ride up out of spools. Hand drill turns spool while file takes off shoulder.

Shim in slot is used to tighten threads. The two rear spools are mounted on 6" machine bolt. If treads are loose, put a shim in slot behind bolt to move spools outward.

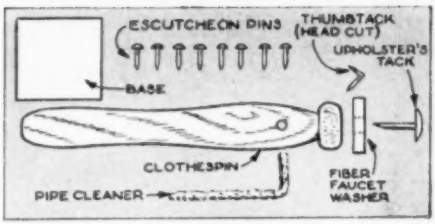


The photos above laid off on squares give you the dimensions for the body of the tank and the step-by-step photos at left show you how to make the parts. The small turrets are not shown, but their construction is obvious.

If you want to, you can leave out the five decorative holes in each side of the two-by-three. They were put in just to break up the blank space above the idlers and to give the appearance of part of the tank's running gear. Two strips of rubber floor matting are ideal for the treads. After you cut the strips to size, sew the ends together to make two continuous belts.

Twelve of the spools are held to the two-by-three by lag screws. The two rear spools—one on each side—are held by the machine bolt that fits in the slot.

The troops. Their bodies are clothespins glued on 1" by 1" bases of ⅝" composition wood. Pipe cleaners pushed through holes drilled in the bodies form the arms. You'll have to cut off the pipe cleaners to shorten the arms. The belts are masking tape and the red stripes down the marines' trousers are cellulose tape. All the buttons are ¼" escutcheon pins.



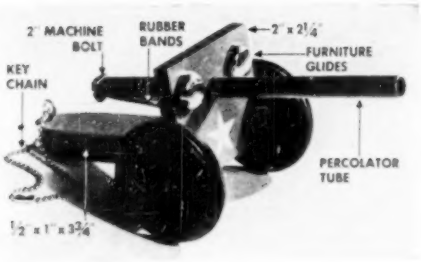
Here are details and color schemes for the troops.

The admiral. His hat is a stamped wing nut held on his head by a roundheaded upholstery tack. Colors: hat, dark blue edged with gold; body, dark blue; arms, dark blue with gold cuffs and epaulets.

The sailor. His cap is a ⅝" fiber faucet washer and an upholstery tack. His collar is masking tape painted white. Colors: body, blue; cap, white. The sailor is the easiest one of the troops to make.

The marine. His cap is like the sailor's, but with a visor added. The visor is a thumb tack with half the head cut off. Colors: cap, white; visor, black; jacket, dark blue; trousers, light blue; belt, white.

The soldier. His helmet is a ⅝" metal washer topped by a roundheaded upholstery tack. His rifle is a 2½" cotter pin with ¼" clipped off the short leg. One end of his arm is twisted in the head of the cotter pin. Colors: rifle, blue; body, olive drab.



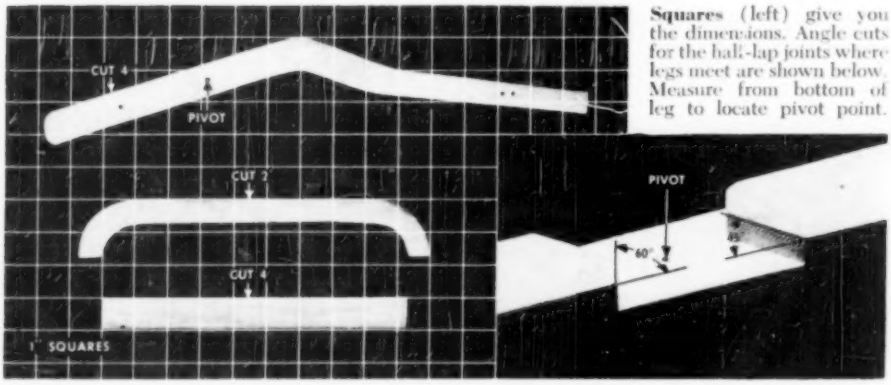
The field gun. This is a simple glue job. The shield and trail are glued together and the percolator-tube barrel is glued into a hole drilled in the shield. The plunger—a machine bolt—that fires short pieces of dowel for projectiles is powered by a rubber band. The rubber is looped through a screw eye in the rear of the shield and through a slot in the head of the bolt. With the exception of the furniture glides and wheels, the gun is painted olive drab. END

Knitting Bag Stands Up

THIS folding bag stands on its own feet and has countless uses. It's handy for sewing, as a carrier for baby things, and you can take it to the beach next summer to keep your books and cigarettes out of the sand.

Enlarge and transfer the patterns to ¾" hardwood, and bandsaw out. When you cut the angled half-lap joints, make the cuts on one side of two pieces and on the opposite side of the other two. Assemble with dowels and glue, using small bolts for the pivots.

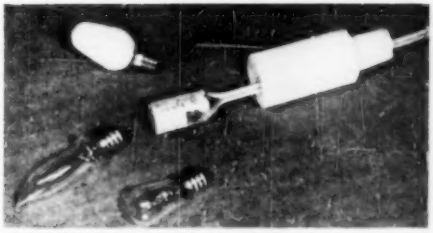
Ask your wife to make the bag from a 12½" by 18" piece of fabric, gathered along the sides to give a cupped shape.—*John A. Vincenti, Kennett Square, Pa.*



Squares (left) give you the dimensions. Angle cuts for the half-lap joints where legs meet are shown below. Measure from bottom of leg to locate pivot point.

Miniature Utensils for a Kitchen Whatnot Shelf

SCRAPS of metal are used by Charles H. Hardy of Los Angeles to turn out miniature kitchen tools, many of them with working parts. The old-fashioned coffee grinder has a tiny grinding unit and a sliding drawer. The mixer has a tilting head and its enameled copper bowl revolves on a turntable. The copper coffepot has a hinged lid, and the kettle has both a removable lid and a spout that pours.



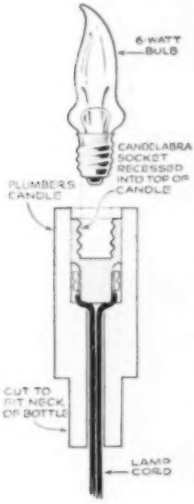
These parts, plus the bottle, make an attractive candle lamp. You have a choice of bulbs, including the candle-flame type, center. All are low wattage, suitable for night lights.

To add to the realistic appearance of your candle lamp, drip some wax from another candle down the neck and onto the bottle. Seal the candle to the mouth of the bottle with soft wax.

How to Make Electric Candles

FOR soft, quiet light, there's nothing like a candle—except an electric candle. This one is an ideal night light or subdued TV lamp.

You can make a candle lamp out of any attractive bottle, a plumber's candle, and a small bulb and socket. First step is to select the bottle—preferably one made of deep-toned glass. Next drill a small hole near the base to allow the lamp cord to enter.



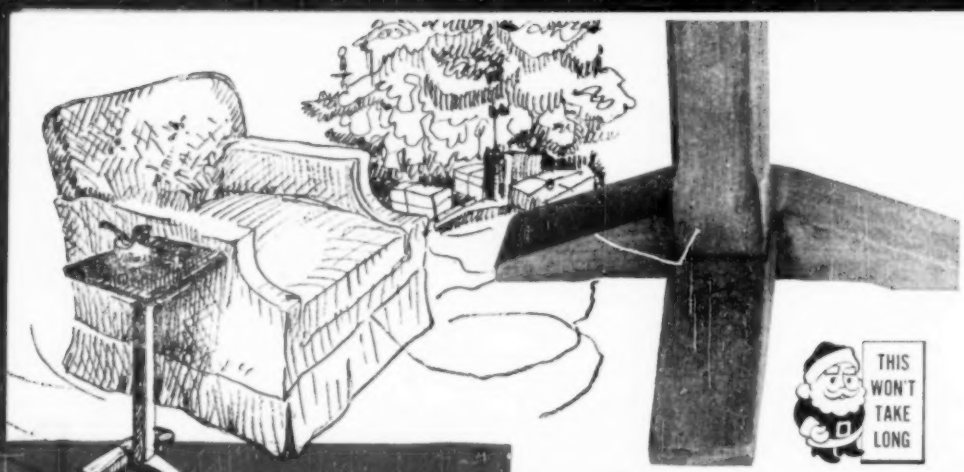
Drilling glass is a tricky job. For tips on how to do it, see PS, March '49, p. 239. Or you can play it safe and let the local glazier do it for you.

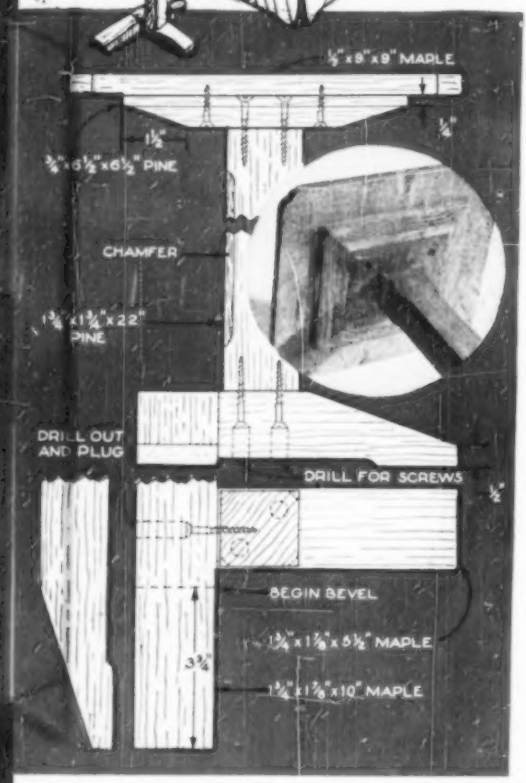
Drill a ¾" hole lengthwise through the center of a plumber's candle, and carve a shoulder at one end to fit snugly into the mouth of the bottle. At the other end of the candle widen the center hole enough to take a small, cardboard-sheathed candelabra socket. ("Candelabra" means a lamp base slightly larger than either the miniature flashlight or Christmas-tree lamp size.)

Bring the lamp cord through the bottle, wire the socket, and your lamp is practically finished. For extra realism, you can melt some wax drippings around the candle neck and down the sides of the bottle.

Geiger Counter for Experimenters

There'll be a Geiger counter in every schoolboy's shop if the makers continue to develop inexpensive models. This one, called the Raytector Kit, sells for $17.50 and is made by Batson Electronics, Inc., Omaha, Nebr. It uses both a headphone and neon flasher to indicate the strength of radioactive materials and operates on a single flashlight battery.





T-Foot Tea Table

By Joseph Aronson

Designer, author of the Encyclopedia of Furniture

JUST big enough for ash tray, book, glass, or cup and saucer, this portable chairside stand will add to any room. The T-foot design comes from an early American table.

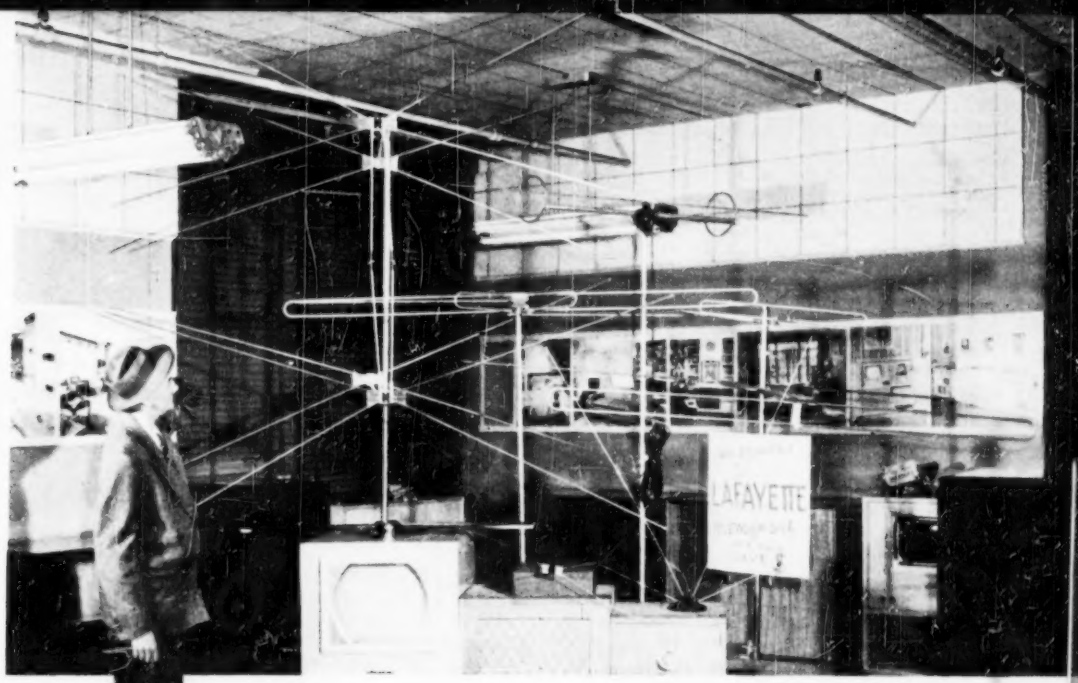
Like the old-time cabinetmakers, you can build the table of any unmatched lumber odds and ends. And don't worry too much about the dimensions. You can vary the proportions quite a bit.

A nicely grained square of maple makes the top. The shaft is pine, and the foot is maple. It's best to dowel together the foot parts and then dowel up into the shaft, but screws set in as shown make the job easier. Screw the top plate to the upper end of the shaft. Then screw the finished top to the plate from underneath. Apply glue to all joints.

Sand off the hard edges. Finish with auto wax to which a touch of burnt sienna in turpentine has been added.

Keep Your TV Screen Clean

You may be able to brighten and improve the picture on your TV screen just by cleaning fingerprints and dust off the safety shield in front of the tube face. Use any mild window spray or cleaner. If the safety shield is plastic, wipe it with a very soft cloth to avoid scratches, which are difficult to remove. Do not apply too much pressure.—*H. Leeper, Canton, Ohio.*



What You Should Know About TV Antennas

There are as many ways of catching signals as there are to skin a cat . . . Which is best where you live?

By Robert Hertzberg

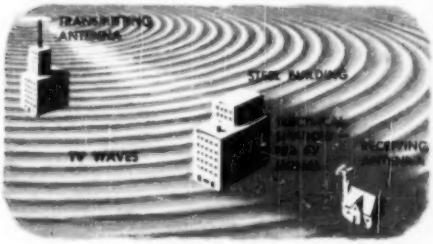
DRAWINGS BY RAY PIOCH

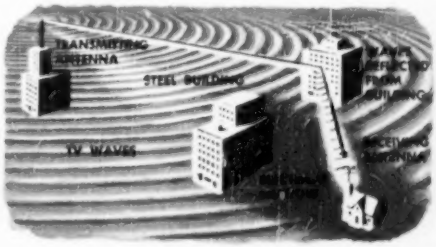
WHETHER your receiver cost $49.50 or $499.50, it has to catch TV signals to produce bright, sharp pictures. Your signal-catcher is your antenna. Luckily, it is something that you often can experiment with profitably, even though you don't know a

ELECTRICAL SHADOWS AND REFLECTIONS

A steel-frame building or other large structure may block off signals, making a receiver in the shadow area useless. This effect is particularly marked on the high-frequency channels.

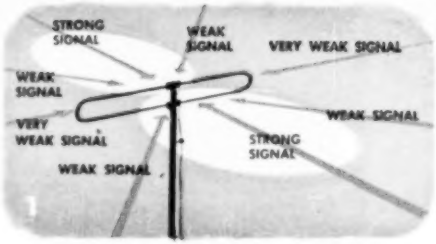
Behaving like light waves, TV impulses under fortunate conditions are sometimes reflected from buildings into receiving aerials in shadow areas. Satisfactory pictures are thus obtained.





DIRECTIONAL PATTERNS

Basic folded dipole (1) receives equally well front and back, poorly off its ends. Reflector added to dipole (2) reduces signals and interference from back, but increases pickup from front. Multi-element antenna (3), with director rods in front of dipole and reflector behind, is called a "Yagi." It is sharply directional in forward plane, has practically no response to side and back, and responds with very high efficiency to signals of single frequency that corresponds to length and spacing of elements.



thing about the complicated innards of a video receiver.

You don't need a single meter or other piece of special equipment. Poles, rods, and wires can be re-arranged with common hand tools. And you may not even have to do any fancy climbing—trial set-ups in the attic may show what can be done where you live with various kinds of antennas. But it helps to know a little about the way TV pictures fly through the air.

Electronic lighthouse. Think of a television transmitter as an electronic lighthouse that shoots out flat circles of invisible waves. These waves respond to focusing, but peter out rapidly as they advance, and can be blocked or reflected by obstacles such as hills and good-sized buildings.

In the U. S., the waves are polarized horizontally. In England, they are polarized vertically, and receiving antennas there look like fishing poles. But our experts chose horizontal polarization, because much of the interference from electrical machinery is vertically polarized, and antennas in this country work better when they are horizontal.

The earth's curvature, height of the transmitting aerial, and the height and position of your own antenna limit the distance at which signals can be caught consistently. This distance is not likely to be more than 75 miles, although many cases of successful reception at greater distances have been reported.

Where are you? If you live out in the wide open spaces, your freedom from interference and ability to place your antenna wherever you please may help you catch TV shows.

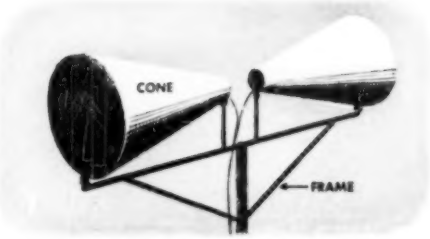
All sorts of things can happen in cities. A woman in a New York apartment enjoyed excellent reception with a simple indoor antenna until she lowered her blinds. Then the screen went blank because the aluminum slats formed a perfect shield.

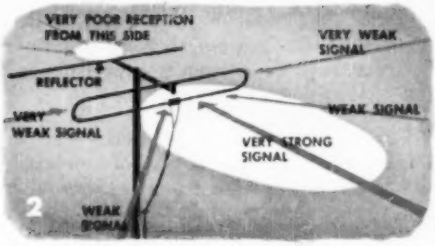
A building between your antenna and the transmitting aerial may cast an electrical shadow within which reception is poor or hopeless. Another building may reflect the signals *into* such a dead spot, and make good reception possible. Or several buildings may act as mirrors and shine several signals into an antenna, producing that multiplicity of images commonly known as ghosts.

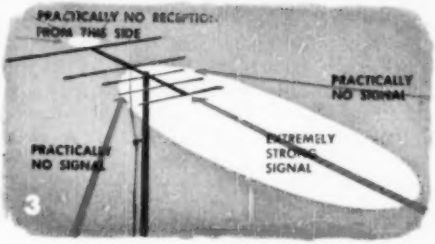
How dipoles are made. The simplest type of signal catcher is a single dipole—a straight rod, tube, or wire about half as long as the waves from the transmitter. It is cut in half, the inside ends are pulled apart a half inch or so, and the two conductors of the lead-in wire are attached to these two halves.

DEVELOPMENT OF CONICAL DIPOLE

Electronically, a dipole consisting of two enclosed metal cones (1) makes an effective broadband antenna, but mechanically it is impractical. Desirable characteristics remain when cones are replaced by basket-weave arrangement of wires (2), or by rods forming V-shaped legs (3). This modified conical, with reflector to give directional pattern similar to that of folded dipole with reflector, is popular because it is easy to erect and pulls strong signals from stations up to about 25 miles away.







The over-all length of a single dipole cut to receive Channel 4 is 80 inches. For Channel 13, by mere coincidence, each arm should be only about 13 inches long. (PS, Sept. '50, p. 237). Inexpensive aluminum tubing, about ¾" or ½" in diameter, is usually used because it is self-supporting and easy to mount. Copper or brass tubing would serve just as well.

Such a dipole receives best from the directions at right angles to the rod. You may not notice any difference if the rod is swung 15° to 20° to either side of the true compass bearing of the source of the signal you want to catch. Nevertheless, this directional effect is often useful in eliminating ghosts.

Folding the dipole. Unfortunately, a simple dipole, cut to the proper length to catch the signals from one station, may not bring in stations on other channels equally well. This difference in the response to different stations can be reduced, however, by "doubling" the dipole. This is done by folding a rod twice as long as would be needed for a simple dipole into a trombone shape.

A folded dipole has the same directional characteristics as a single dipole. But a double dipole cut to the proper length for Channel 4 will usually work better on Channels 3 and 5, and 2 and 6, than a single dipole of the same length.

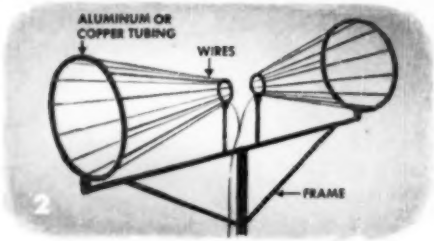
These channels, 2 to 6 inclusive, constitute the low band of TV frequencies. The other channels, 7 to 13 inclusive, are the high band, and to receive them, a separate, shorter dipole is often added to an antenna.

Adding a reflector. There also are other ways of improving a dipole's performance. A separate, slightly longer rod, for example, can be fastened to a crossarm on the mast so that it will be in a horizontal plane behind the dipole and serve as a reflector. No wires are attached to this extra rod—but its spacing in relation to the dipole is somewhat critical.

Its distance behind the dipole should be between a tenth and a quarter of the length of the desired incoming waves. When this distance is right, the extra rod picks up energy from the station toward which the dipole has been faced and bounces this additional energy back into the dipole. And at the same time it serves as a shield against waves coming from the rear that might interfere with the reception of the desired signals.

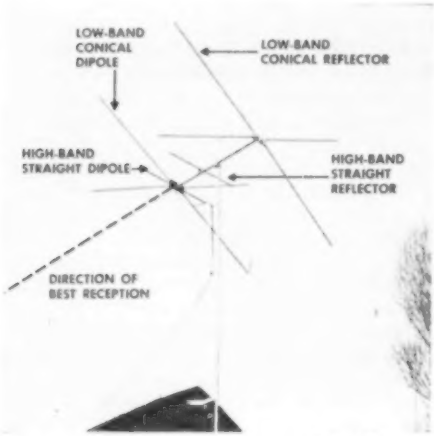
Adding a director. An unconnected rod can also be placed in front of a dipole. It then becomes a director if it is made a trifle shorter than the dipole, and spaced so that energy is re-radiated from it to the dipole to strengthen the signal received.

When a director is used, the spacing is

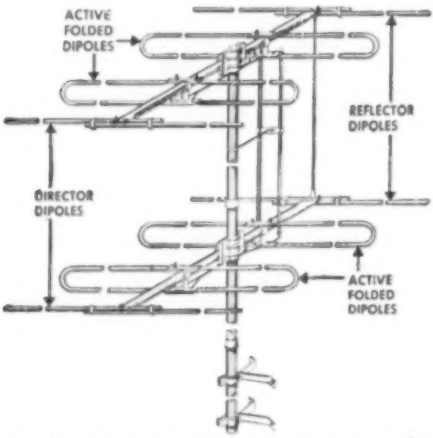


extremely important. It is roughly a tenth of a wavelength (one fifth the length of the dipole), but should be adjusted on the spot for best results. If this spacing is wrong, the secondary signals that the director shoves into the dipole will tend to cancel out the signal that the dipole picked up on its own hook, and the result will be a poor picture or no picture.

The more reflectors and directors that you add to an antenna, the more heartily it can feed signals into your receiving set—but at the same time the directional or beam effect of the antenna becomes narrower. Hence, such an antenna is most likely to be desirable where you only hope to receive the signals from one station or from stations that are geographically aligned.



Typical modified conical antenna, with additional high-band dipole and reflector to give extra gain on channels 7 to 13, is shown above. Direction of best reception is to left.



Special stacked twin-driven "Yagi" antenna, for use on a single channel in fringe areas or other difficult locations. Directional effect is very sharp; spacing of elements is critical.

A particularly useful type of antenna has five elements and is called a Yagi after a Japanese engineer who worked out its tricky spacing. A Yagi has three director rods, a dipole, and one reflector. Pointing one of these things is almost like shooting with a rifle.

Stacking 'em up. It is also feasible to mount several ordinary two-element beam antennas, one over the other, on a common pole, with a common lead-in. Such an arrangement is called a "stacked array."

Its advantage over the Yagi is that it retains the relatively broad-band frequency coverage of the basic dipole. But a stacked array can become clumsy. A stacked array having four two-element beams, for example, may require a reinforced tower of some kind.

Conical frames. Probably the best general-purpose TV aerial, electronically, would be a dipole with the elements in the form of closed metal cones. As a mechanical body it is impractical. Its desirable broad-band characteristics can be largely retained, however, by replacing the cones with a basket-like arrangement of wires. And experimenters who kept removing a few wires at a time discovered that such an antenna still worked well with only two rods on each side, fanned out to form a wide V.

This modified "conical" can be backed up with reflectors and stacked in the form of arrays, and is proving successful where the available stations are distributed over both low and high bands.

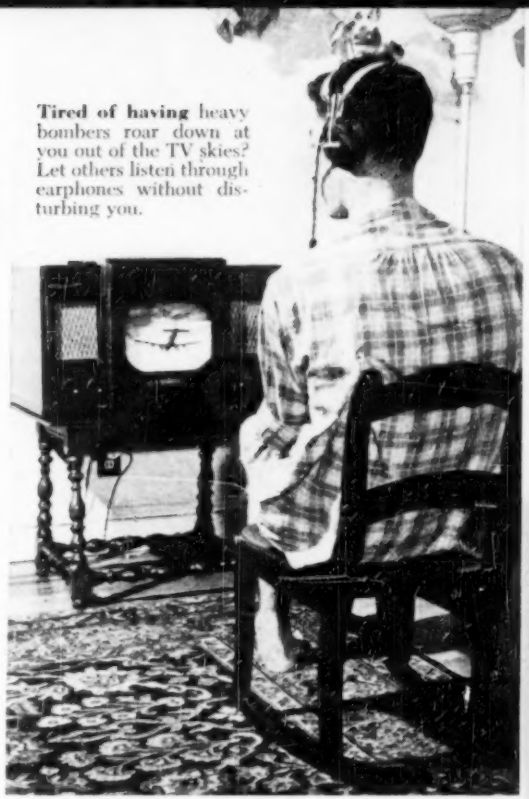
But the directional property of beam antennas is not an unmixed blessing. Suppose you live between two stations. If you aim your antenna at one, you may not get a glimmer out of the other station. But there are two ways to overcome this trouble: Use two antennas and switch from one to the other, or make your antenna rotate so that it can be aimed at either station.

Tricks such as these are enabling the kids to enjoy Hopalong Cassidy where satisfactory reception would be impossible otherwise. END

Next month* POPULAR SCIENCE *will report "The Best Ways to Mount TV Antennas."

How to Hush Your TV Set

You can escape the kids' pictures by leaving the room. Don't let the sound follow you.



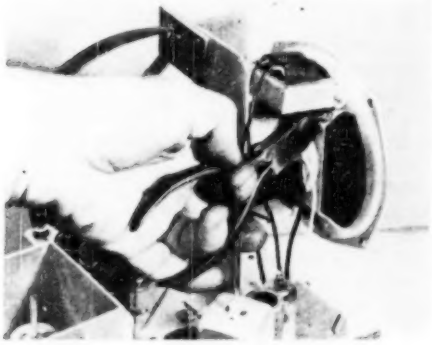
Tired of having heavy bombers roar down at you out of the TV skies? Let others listen through earphones without disturbing you.

PEACE in a television home is easily restored—if you provide earphones. Gun-shy parents then can enjoy their newspapers while the children watch the cowboys and Indians. And the kids can sleep undisturbed while father catches a late wrestling match or prize fight.

An "earphone attachment" is simply a 2" by 4" strip of plywood or composition board on which a standard phone jack and a single pole, double throw toggle switch have been mounted. It can be attached to the back edge of the cabinet or screwed to any convenient ledge near the receiver.

The hardest part of the job is getting at the loudspeaker. Many cabinets are put together in sections, and the top or front panel can be unscrewed for ready access. But in other cases the chassis may have to be taken out. To do this, pull off the knobs and loosen the bottom bolts. Then make sure that the front of the picture tube is firmly supported when you slide the assembly out.

To add earphones you have to cut only one wire in the receiver. Between the speaker and the output transformer—which is usually bolted on the speaker frame—there are two stiff-wire voice-coil leads. Snip either one of these leads. Solder extensions to the cut ends and bring them to the toggle switch. When the switch is in one position, the set will operate exactly as before. Solder another wire to the other side of the



Cutting either of two voice-coil leads is only change needed in receiver. Snipped ends go to toggle switch. Make sure picture tube is supported if you remove chassis from cabinet.

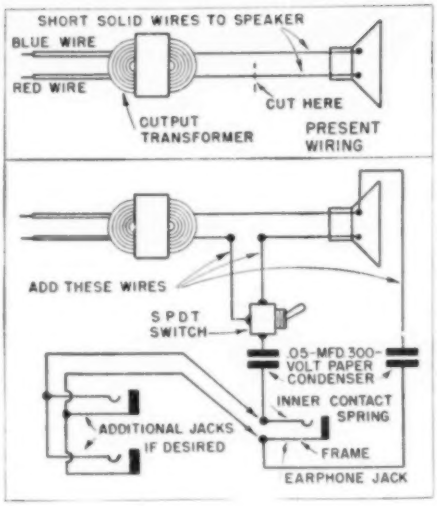
Small panel for phone jack and toggle switch may be mounted at back of cabinet or near set. Condensers are on other side of strip. Surplus Army phones come equipped with plug.

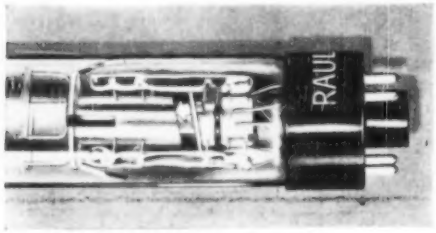
speaker voice coil and connect an earphone jack and two condensers, as in the drawing.

There is no danger from shock, as the earphones are isolated from the high-voltage portions of the circuit by the output transformer and additionally protected by the condensers in series with the speaker leads. These condensers may be of any capacity from .05 to .25 mfd.; rated working voltage should be 300 volts or more.

The earphones may be either the low- or high-impedance type. Signal Corps surplus phones are fine. As many as a dozen pairs can be used simultaneously if extra jacks are connected in parallel. Kids love to wear phones: they give 'em that Captain Video appearance.

P. S. You can use exactly the same rig on any radio if you want to protect yourself against old-fashioned ear-busters. END





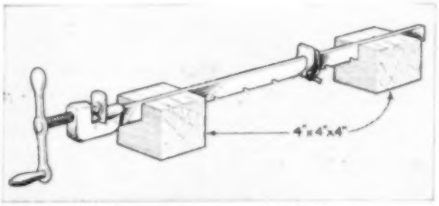
Glow Shows TV Misalignment

EVERYONE who has serviced or adjusted TV receivers knows the importance—and the difficulty—of aligning the ion-trap magnet. Misalignment cuts down picture brightness, fuzzes the focus, shortens picture-tube life.

The ion-trap magnet, which fits around the neck of the tube, bends the electron beam so that it can pass through a small aperture in a metal disk (see arrow). With ordinary tubes it is difficult to know when the magnet is properly adjusted. Now a new indicator ion trap, used in tubes made by the Rauland Corporation, Chicago, gives positive indication of alignment. A fluorescent coating on the disk does the job. When the electron beam is improperly adjusted, it hits the coating and causes it to glow. The ion trap is adjusted by moving the magnet until the glow disappears.

Synthetic Beef

A NEW food, made from dried skim milk and yeast, has been developed by researchers at the University of Arkansas. Golden brown in color, it has taste and texture similar to beef but costs one third less.



Blocks Support Bar Clamps

GLUING up lumber is easy—if you have four hands. But if you have only the normal number you've probably had trouble trying to manage the work and the clamps at the same time. One way of simplifying the job is by making supporting blocks for your bar clamps. For each clamp slot a pair of 4" hardwood cubes as shown. They will hold the clamps steady while you line up the work before tightening up on the screws. —*C. R. Schlegel, Jenkintown, Pa.*

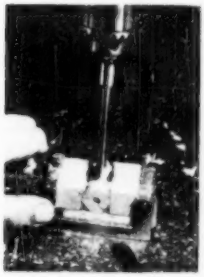
Shop Use for Old Calendars

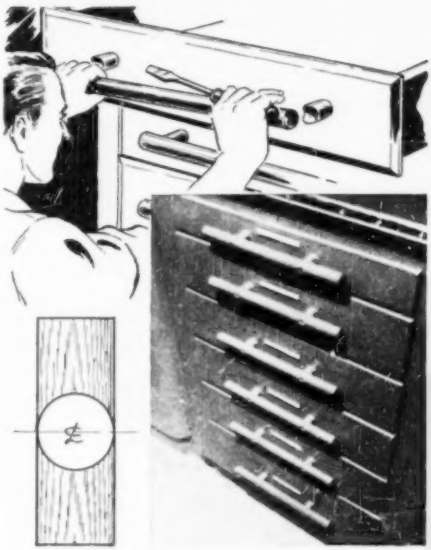
DON'T throw away your old wall calendars. Shop bins, drawers, and jars containing nails or screws, bolts or nuts, and other small parts can be neatly marked for size with the numbers cut from a few old calendars. Glue the numbers to the face of the container and coat with clear varnish. Calendars showing the current month in big figures and the past and coming months in small figures are fine where fractional and whole numbers are used together. You also can use cutout letter to form word labels.—*Warren W. Howe, Longview, Wash.*

Hardwood Dowels Make Good Handles for Shop Drawers

NEAT handles for shop drawers are easily made from hardwood dowels fitted with spacers of the same material.

Make the spacers two at a time by cutting them twice the required length from drawer face to handle (usually about ⅜") plus the diameter of the dowel. Drill each piece through the center lengthwise, then place in a scrap-wood jig in a drill-press vise as shown. A Forstner bit or drill-press auger of the same diameter as the dowel will cut through the exact center of each piece. This yields two spacers with one end of each shaped to fit the dowel handle. Now drill and countersink the handles at two points and screw to the drawer fronts.—*Will Thomas, Buffalo, N. Y.*



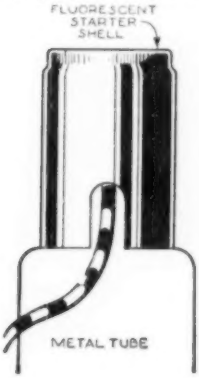


Refrigerator Bag Protects Clothes

TAKING a trip? Carry your shoe-polishing paraphernalia zippered up in a plastic refrigerator bag and you won't stain the clothing in your suitcase. These bags pack shoes cleanly, too. Smaller ones are excellent for cosmetics.—*Morris Williams, Troy, N. Y.*

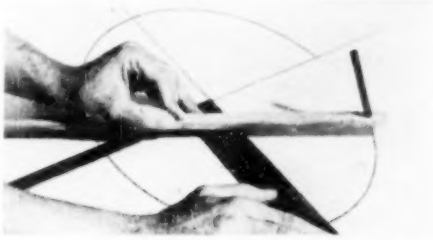
Shield for Metal-Tube Grids

GRID shields are often used in radio and amplifier circuits to reduce noise pickup. You can make an effective shield for the type of metal tube that has an exposed grid cap on top by using the shell of a discarded fluorescent starter. The aluminum shell fits snugly on top of the tube; all you have to do is bend up the tabs that hold the shell to the base and cut out a small opening for the grid lead wire.—*H. L. Davidson, Ft. Dodge, Iowa.*

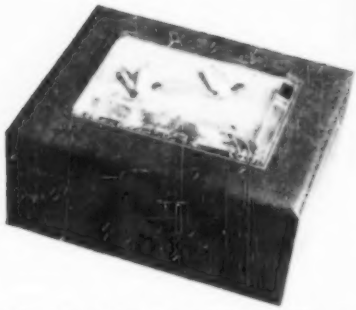


Tool Draws a Perfect Ellipse

LAYING out an ellipse is easy with the tool shown in the photos below. It's a strip of wood, drilled at one end to hold a pencil, and two brads that are driven into the strip. By moving the brads against the edges of a framing square, the pencil traces out one quarter of the ellipse. Turning the square and repeating the movement gives a perfect oval. The distances from the brads to the pencil point govern the size of the ellipse. Make the distance from the pencil to the first brad one half the minor axis. Make the distance from the pencil to the second brad one half the major axis.—*Hugh Lineback, Stillwater, Okla.*



CRAFTSMEN AT WORK



Plastic Blends with Leather. Game birds and fish, internally carved in acrylic, are aptly framed for the sportsman's den in these leather-covered book ends and a matching cigar humidor. The ¾" thick carving is backed with a thin sheet of tinted plastic. All exposed edges are beveled 45°. Made of wood, the book ends and humidor are covered with richly grained leather. Carvings are dyed in natural colors and look like embedded miniatures of the real things. They were executed by Harry Zoback, author of the book *Internal Carvings in Plastics*.

Cigarette Box Hits New Note. This miniature piano puts a musical C in cigarettes. William Freeman, of Baldwin, L. I., built the baby baby grand, using walnut for the body and a thin veneer for the keys. He turned the legs from hardwood dowels and jigsawed and molded each part individually.

Power Plow Makes the Snow Fly. Light enough to be handled by a woman, the plow shown at right makes short work of clearing a path from a driveway. Its rear rubber wheels, chain-covered for traction, are propelled by the same motor that drives the scoops. Built by George P. Metesky, of Waterbury, Conn., it is powered by a ½-hp. electric motor. If desired, a gasoline engine can be substituted. The plow weighs 75 pounds, can dig through a three-foot bank, and throws snow 15 feet.

Our new mailbox is just a dressed-up version of the old one, left. It rings a bell inside the house every time the door is opened or closed.

Mailbox Rings Bell

Why dash out in all kinds of weather to see if the postman left something? Here's a way to tell from inside.

By Karl Greif

WE NO longer have to wonder whether the mailman's been along. An antique bell on our living-room wall announces the arrival of mail. It rings twice—once when the box is opened and again when it is closed.

The bell ringer is just one of our mailbox improvements. Another is the ox-drawn covered wagon that decorates our front lawn. The wagon is built around a standard, approved mailbox. The plans on the following pages are scaled to a small-size box, but they can readily be enlarged to suit bigger boxes.

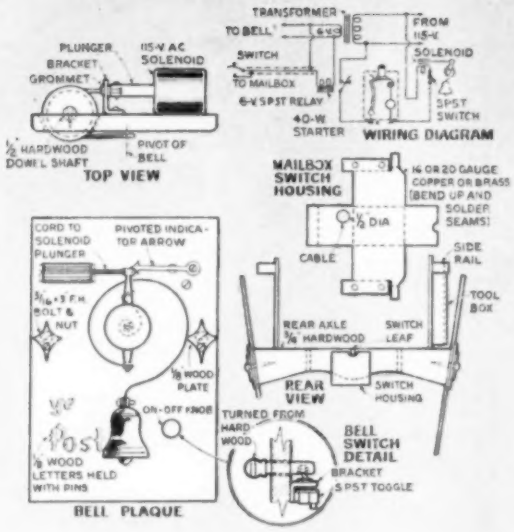
Outdoor parts: Four wheels, eight hub disks, two oxen, and the driver are cut from 3/32" aluminum. Trace the designs on heavy wrapping paper, cement them to the metal, and jigsaw the cutouts.

Make all wooden parts—such as axles, yoke, side rails, toolbox—from a hardwood that can stand exposure to the weather.

A leaf-type, normally open, midget snap switch on the mailbox actuates the signal inside. Hold the switch in the position shown in the drawings. Open and close the door, and move the switch till you find a

I designed a bell plaque to blend with our furnishings. It could be made to any pattern or even concealed in a shelf or closet.

When the solenoid, upper left, is energized, it tugs the bell. The spring-mounted bell jangles for a couple of seconds after the plunger drops back. A switch, lower left, turns off the power.



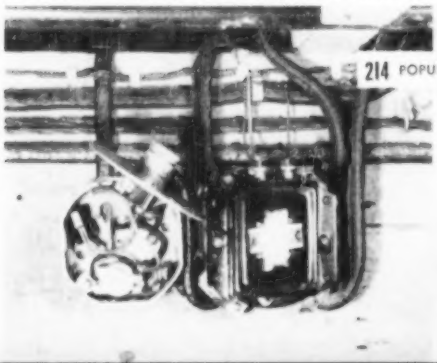
A hole in the wall allows surface mounting of the bell plaque. Cutting this hole could be eliminated if parts on back of board were boxed in.

spot where it will be actuated *momentarily* at some point in the door's arc.

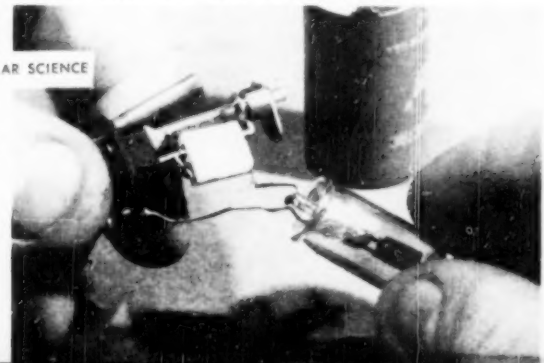
To connect the switch to the bell circuit, use a weatherproof wire such as surplus coaxial cable or a vinyl-insulated wire. A lead-sheathed cable is ideal, but it is costly and isn't needed in this low-voltage circuit. Bring the wire down through or alongside the box support and into the ground. Dig a shallow trench from the base of the support to a convenient point of entry at the house.

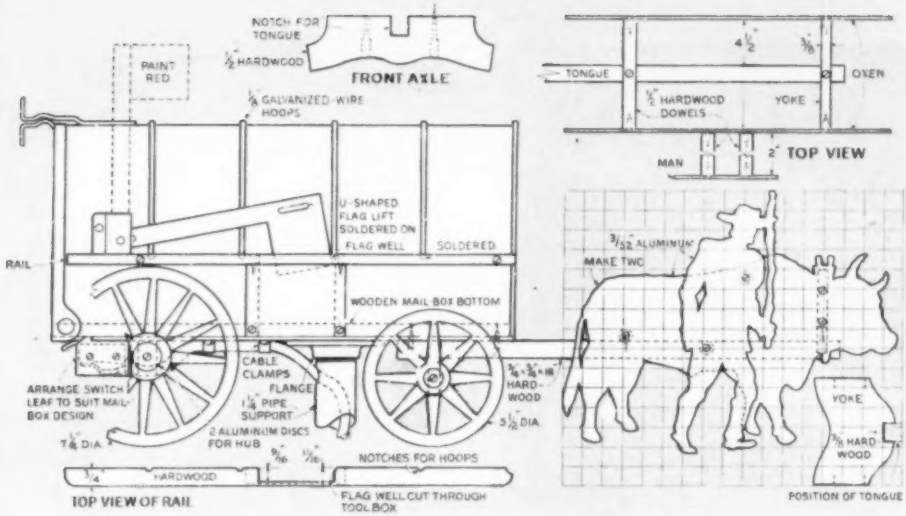
Indoor parts: Our bell plaque, mounting an old-fashioned doorbell, was designed to have a mildly antique look; other possibilities include using a dinner bell, cow bell, or just a concealed indicator. Since my bell must be rung by a short pulse of current, I suspended it from a coiled strip of ½" spring steel so that it would keep jangling for a couple of seconds after it is yanked. To furnish the pull, I mounted a solenoid at the back of the bell plaque and connected

Relay and circuit breaker, housed in standard junction box, are mounted near the doorbell transformer to keep connecting leads short.



Circuit breaker is a modified 40-watt, reset-type fluorescent starter. The bulb inside is discarded. Leads that went to it are joined.





it to the bell by waxed cord and a pulley. (The solenoid I used, made by the Guardian Electric Mfg. Co., Chicago, is model No. 4, for *intermittent* use on 115 volts AC.) I also added a switch to keep the bell from ringing when someone is sick.

If you wish a further indication of the mailman's coming, you can pivot an indicator arrow (see drawing) so that the tip rests on the bell-pull arm. When the solenoid pulls the arm, the arrow falls and stays down until it is reset.

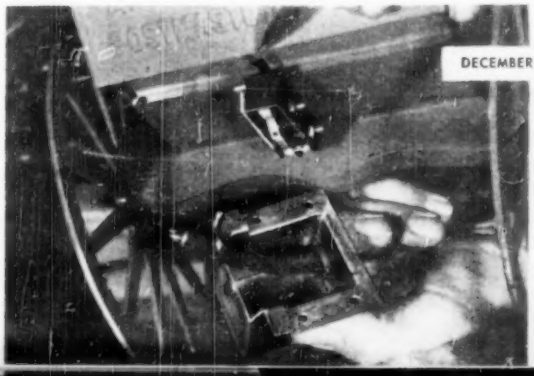
Wiring for safety: The wiring diagram is a bit more complex than it has to be, but it includes a couple of worthwhile safety features. A regular two-wire cable goes from the 115-volt house line to the solenoid and switch. All the rest of the wiring is at low voltage.

Connect the wire from the mailbox to the low-voltage side of your doorbell transformer through a 6-volt, SPST, AC relay. If your bell transformer isn't conveniently located, use a separate transformer.

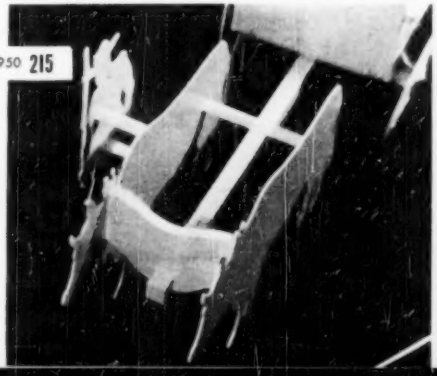
A time-delay cutout or circuit breaker in the solenoid circuit is another safety feature, for the solenoid will overheat if it's energized for long periods. This might happen if the switch jams or if something goes wrong with the wiring. The shut-off is adapted from a 40-watt, cutout type of fluorescent-light starter (the kind that has a reset pushbutton on the end). Remove the starter from its aluminum shell, and short out the starting contacts. You can do this by snipping out—and discarding—the glass cartridge, and joining the two leads that went to it. Twist the two wires together and add a drop of solder to the joint.

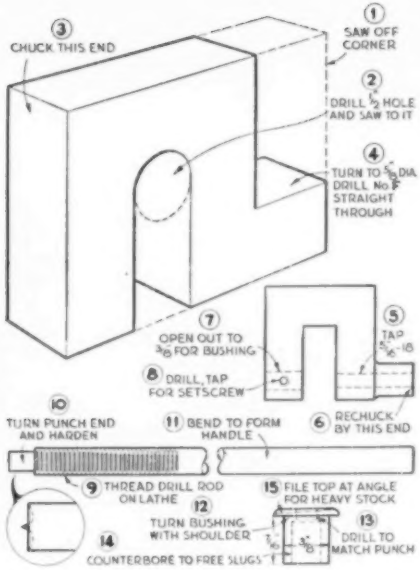
If the solenoid draws current for more than a minute and a half, the starter cutout contacts will snap open. After you have corrected the trouble, press the reset button to put the system back in operation. END

Leaf of midget snap switch is actuated by the opening and closing of mailbox door. Soldered-up metal box protects switch from the weather.



Wooden yoke and wagon tongue hold oxen in position. Driver is held by dowel spacers. Supports should be made of close-grained hardwood.





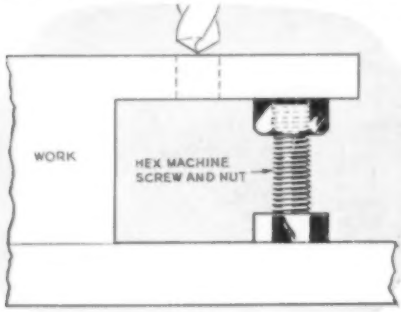
Sheet-Metal Punch Uses Screw Action. Clamped in a vise, this punch pierces husky sheet metal at the turn of a handle. The anvil and the threaded punch are removable, so several can be made up for different holes.

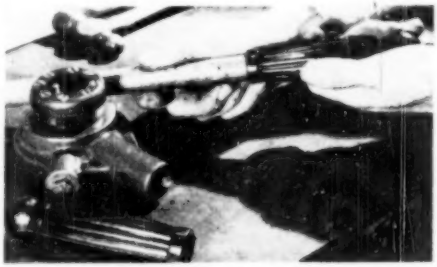
The body, sawed from ¾" steel, can be chucked off center in the four-jaw, or gripped between two jaws of a universal chuck, as shown in the photo, with a block under the third jaw.

A square end will serve on the punch, but the pointed, hollow-turned one shown in the drawings cuts more cleanly. The point also makes it possible to locate holes accurately on a punch mark.

For punching heavy stock, file the top of the anvil bushing at an angle to get a shearing action. Harden both the anvil and the punch end; then draw to a light straw color. —*Floyd McGuckin, Ridgewood, N. J.*

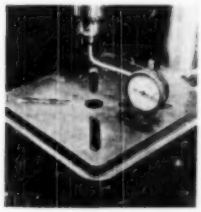
Bolt Acts as Jack Screw. When a shorter than standard jack screw is called for, an ordinary machine screw and nut may serve the purpose, as shown below. Cut the screw to length, face the head square in the lathe, and put the nut on upside down. Back the nut off to tighten.—*H. Sevcik, Los Angeles.*

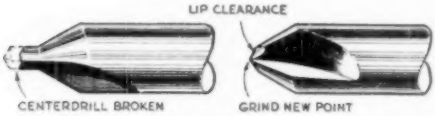




Grip Improves Die Stock. A bicycle handle-bar grip, shown above, makes the pipe handle commonly used on ratchet-type die stocks easier on the hands. It also prevents marring of walls or other surfaces if the handle strikes them. Should the grip fit loosely, wrap friction tape around the handle first. Pad the end with a bit of waste or rag to keep it from cutting into the rubber. —*Walter E. Burton, Akron, Ohio.*

Squaring Drill-Press Table. A table that isn't exactly square with the spindle of a drill press can cause a lot of grief. If you have a dial indicator, you can check yours quickly, as shown at left. Thread one end of a steel rod, bend it to a right angle near one end, and mount the indicator with a couple of nuts. Chuck the short end firmly. Moving the indicator cautiously around the table will provide test readings. To test the base table, use a longer rod.—*Will Thomas, Buffalo, N. Y.*

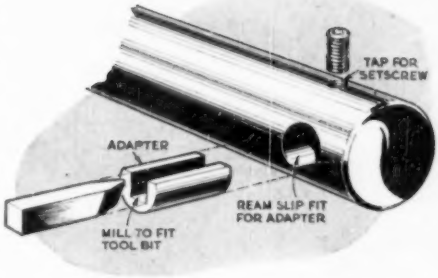




Centerdrills Salvaged. Instead of throwing away broken centerdrills, regrind them, as above, to a new point, with clearance back of cutting lips. Although no longer good for making center holes, they are handy as starting drills on lathe or drill press, and less likely to break than a good centerdrill.—*Henry Sevcik, Los Angeles.*

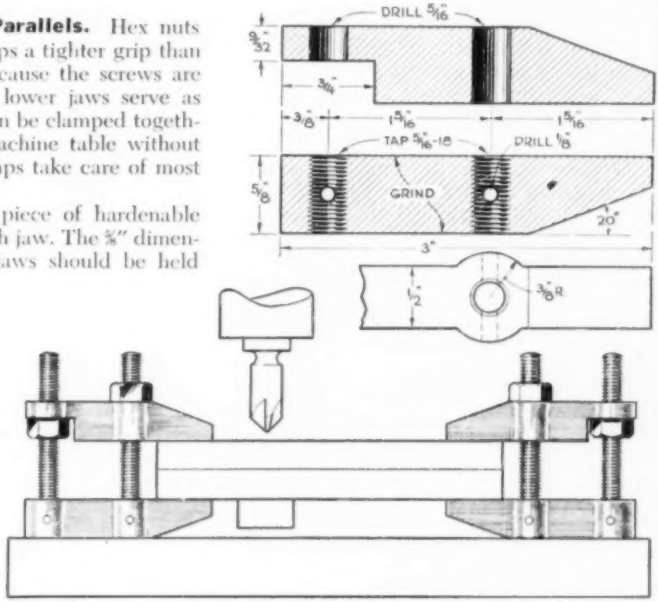
Clamps Double as Parallels. Hex nuts give these rugged clamps a tighter grip than ordinary ones—and, because the screws are on one side only, the lower jaws serve as parallels. Thus work can be clamped together and set up on a machine table without extra pieces. Four clamps take care of most jobs.

A ⅝" by ¾" by 3" piece of hardenable steel is required for each jaw. The ⅝" dimension of all the lower jaws should be held to a close tolerance, preferably by surface grinding. Drill across the threaded holes for pins cut from ⅛" brazing rod to anchor the 3" long screws, which can be made of drill rod. Thread them 5/16"-18 all the way. Harden and temper all parts before assembly. —*Jesse R. Lucas, Michigan City, Ind.*



Adapter Squares Round Holes. Hand filing square holes in boring bars is a tedious job. The simple dodge shown above not only saves a lot of work, but eliminates all need for scrapping a bar just because tool-bit holes are worn. Mill a piece of drill rod to fit the bits. Then drill a round hole in the bar and ream it to a slip fit for the adapter. Drill and tap a cross hole for a headless setscrew, which holds both bit and adapter.—*Irving Mansfield, New York.*

Color Spots Tapped Holes. In tapping blind holes, it's often necessary to use both starting and bottoming taps. If white lead is used to lubricate the starting tap and red lead for the other, holes are readily identified.—*Harold Hiatt, Michigan City, Ind.*

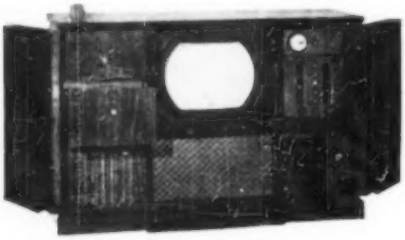


Glass Panel Protects Kitchen Wall

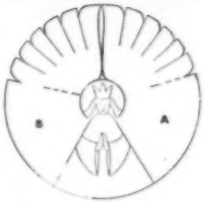
A SPLASH panel of structural glass is one answer to that problem area behind the stove. Easily kept clean with a damp cloth, it protects the kitchen wall from grease, grime, and heat. The 44- by 28-inch panel is set into the wall plaster in homes under construction. In existing homes, the householder determines the stud positions before ordering, and the glass is drilled to order. Decorative screws mount it to the wall. The Pittsburgh Plate Glass Co., Pittsburgh, Pa., makes the panels in many colors, including white, ivory, green, and blue.

This TV Set Even Listens for You

IF THE music box below doesn't entertain you one way, it will another. It's Du Mont's "Westminster"—a combination of a 19-inch television receiver, an AM and an FM radio, a three-speed record changer, and an automatic, twin-track tape recorder that makes possible one hour's playback. The recorder picks up from its own microphone or off any of the other services and can be played back immediately. There's also a clock to turn any part of the combination on or off at preselected times.



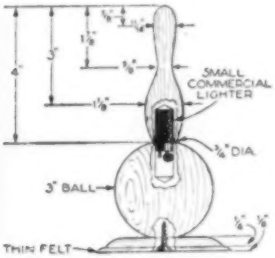
Make Paper Angels for Christmas



You don't have to be an artist to make the complacent little angel shown at right. And it's so easy to make you can quickly snip out several to serve as place cards at Christmas parties. Draw the design on heavy white drawing paper and tint with pastel colors. Cut out the circle and cut in on the dotted lines as shown in diagram. Slide wing slot A into slot B. Bend the wings forward until the figure stands firmly with wings close to the body. Silver or gold foil can be pasted on to add glitter.—*Hans Schmidbauer, Augsburg, Germany.*

Use Same Brand of Motor Oil in Car

USE whatever motor oil you like in your car—but stick to the same brand. It's a good idea not to mix brands, for they may contain different additives that will work in opposition to each other. Additives are used to give various desirable characteristics to oil.



Cigarette Lighter Designed for Bowlers

THIS lathe-turned cigarette lighter will delight a bowling fan. Inscribed about the base, it makes a fine trophy. Turn the wooden parts from any hardwood. (I made the base and ball from maple, and the pin from mahogany.) Flatten the ball slightly at opposite ends so that base and pin fit neatly.

Drill the ball and pin to give the lighter a tight fit in each. If desired, the base may be routed out and filled with lead shot so it will also serve as a paperweight. Finish with clear lacquer or shellac.—*Anthony M. DeNardo, Brooklyn, N. Y.*

Before refinishing, the pair of handsome chairs at left looked like the two at right.

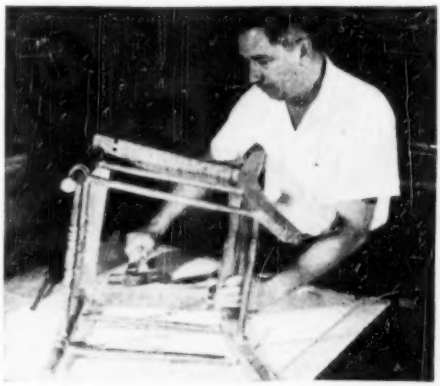
Treasure Hunting in Your Attic

That's where these chairs came from—and rejuvenating such cast-off furniture as this is a challenging pastime.

By Denis Sneigr

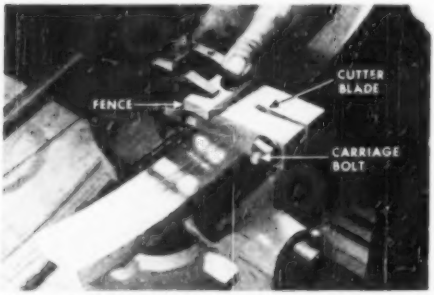
PS PHOTOS BY HUBERT LUCKETT

NOT even the junkman would take the four old chairs. Besides showing the scars of decades of use, they had taken a beating in a flood. The joints were loose, back center rails were missing from two of them, and what was left of the finish was

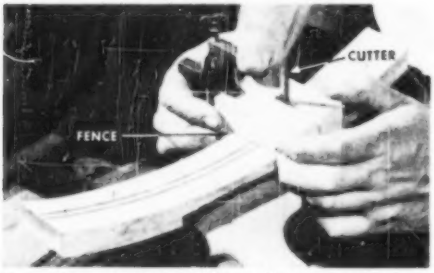


Taken completely apart, the chairs had the old finish stripped off with paint remover. All parts were sanded smooth and clean.

Missing back center rails were duplicated with homemade scratch stock. Cutter of scratch stock is being filed to shape (left).



View of underside of assembled scratch stock. Cutter is locked in slotted block by clamping action of tightened carriage bolt.



Scratch stock is used by pulling or pushing it along work while fence is held tightly against one edge of work. Cutter carves molding.

Chairs were glued up after replacement parts were made. Doweled seat frame is being fitted here. Twisted rope can sub for clamps.

scaling and mottled. The old seats were missing from all the chairs, too.

Piled in a corner of the attic and covered with dust and cobwebs, they looked pretty terrible. But I thought I'd see what I could do with them. The results were impressive. A $25 outlay for materials, plus several evenings' work, turned out four handsome, ladder-back side chairs.

First step was to take the chairs completely apart. Every joint needed new glue anyhow. And it was easier to work with the individual rungs, legs, and rails while taking off the old finish with paint remover.

After the old finish was removed—and that wasn't hard because of its bad condition—all the pieces were sanded smooth.

Duplication of the missing back center rails came next. These are the curved pieces across the back of the chair. Using one of the old rails, a pattern was laid out and the new rails cut out on a bandsaw. (If you don't have a bandsaw, a carpenter shop will do this sort of job for you.)

Making a Cutter

The molding on the rails was reproduced with a scratch stock having a cutter made from an old file. A chisel or saw blade could have been used. To make such a tool, you heat the metal—on the kitchen stove if necessary—until it turns dull red, then let it cool slowly out of drafts. This softens the metal so you can shape it with a file or grindstone.

Shaping it to match the old molding is just a case of trial and error. File or grind the metal until your cutter fits snugly in the molding you want to duplicate.

Just to be sure, you can make a few trial cuts with the tool before you re-harden and temper it. Then take it back to the stove, heat it to a cherry red, and plunge it into a can of salt water—about a tablespoon of salt to a pint. This treatment re-hardens the metal. In fact, it makes it so hard that it is brittle. In this condition, thin parts of the cutter might break in use. Before you temper it, rub the cutter with emery cloth to bring back the brightness of the metal.

This time heat the cutter cautiously until the edge turns a straw color. Be careful not to overheat it; fan it back and forth through the flame. The moment the straw color reaches the edge, dip it again into the salt water. Then you're ready to mount the cutter in a scratch stock.

The chairs were reassembled with glue

Paper pattern was made from new plywood seat base and laid out on the cloth. Allowance was made for material to lap under seat.

Half inch of foam rubber was cemented to plywood seat and brocaded rep tacked in place. Corner is being mitered in photo above.

and clamps. While the glue was setting, the new seats were made. These were ⅜" plywood cut to fit, with ½" sponge rubber for padding and a covering of brocaded rep (an upholstery fabric). Four screws from underneath the seat rails hold the new seats in place.

How They Were Finished

Before the new seats were fastened, the chairs were finished. Of course, there are a variety of finishes you can use when refinishing old furniture (PS, Aug. '50, p. 158), depending upon the kind of wood. These old chairs were made of maple. In some of the pieces the grain wasn't good looking, so they were given a finish that concealed almost all the grain. In finishing these chairs, each one was:

- Sprayed with penetrating walnut stain;
- Given an alcohol rubdown to remove spray dust and to bring out some grain highlights;
- Sprayed with lacquer sealer;
- Wet-sanded with No. 400 paper;
- Rubbed with No. 00 steel wool;
- Sprayed with lacquer sealer; and

When new finish was dry, new seats were anchored in place with four flat-headed wood screws driven into plywood from under seat rails.

- Sprayed lightly with clear lacquer thinner while still wet from the second coat of lacquer sealer.

The lacquer thinner acts as a surface solvent, dissolving spray dust from the lacquer sealer and toning the surface to an even gloss. END

Tape Protects Jigsaw Patterns

COMMERCIAL scrollsaw patterns are printed on flimsy paper since they are intended to be glued to the wood and used only once. When I want to use the same pattern several times, I cover the lines with cellulose tape and transfer the design with carbon paper. The first time I use the pattern I trace the lines very carefully. The small track that is formed in the tape makes it easy to follow the lines in subsequent tracings.—*H. Chatillon, San Francisco.*

Salvaging Nail-Polish Brushes

THE better grades of nail polish are sold with very fine applicator brushes. When the bottles are empty, you can salvage the brushes. Cleaned with polish remover or lacquer thinner, cut free of the bottle cap, and fitted securely to a wooden handle, they make excellent paint brushes for children. Save some for use in the shop; they are also fine for dusting or painting models or delicate optical and electrical instruments.—*Kenneth Murray, Colon, Mich.*

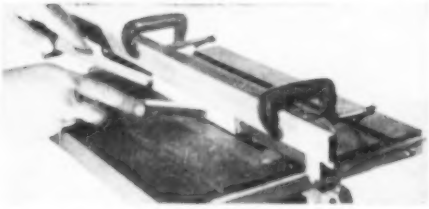
Clamps Make Sawing Safer

THE blade of a circular saw is all right in its place. One of the places where it isn't all right is too close to your fingers. The photos below are reminders of three easy and safe ways to handle ticklish jobs.—*Louis Hochman, Sherman Oaks, Calif.*

Cross cutting large work can be handled on small saw by clamping guide strip to underside of work. Guide strip rides against side of saw table as work is fed through saw.

End grooving (left) can be done safely this way. Work is clamped to strip that slides along the top of fence as work is pushed into blade. Pusher stick holds work against fence.

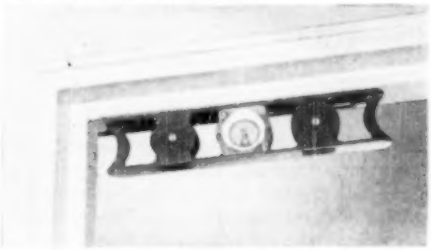
Edge grooving small pieces (below) is done safely when strip is clamped to fence. Pusher sticks keep fingers away from blade. Work should fit snugly between table and strip.



Screwdriver Holds Three Bits

THIS magazine-loading screwdriver drops another bit into place for use as you remove one from the chuck. The bit you remove then is reloaded into the handle, as shown at right. The three bit sizes are 3/16" flat, 9/32" flat, and No. 2 Phillips. Selecto Products Company, of Cleveland, Ohio, prices the tool at $1.50.

Level Sticks to the Job

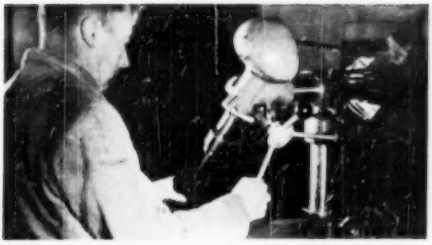


PERMANENT magnets in the case of this level hold it to any ferrous-metal surface, leaving both your hands free for the job. Instead of the usual bubble, this level has a dial that registers from 0° to 360°. The tool, priced at about $6 by the Buckeye Plastic Corporation, Cleveland, Ohio, sticks to round or flat surfaces.

Tool Tightens Floor Boards

PULLING the lever of this tool forces tongue-and-groove floor boards tightly together for nailing. Eighteen spikes on the underside bite into the subflooring to give you a firm grip. The tool—with the proper facing insert—also can be used for laying roof boards, parquette flooring, putting up shiplap and other siding, bracing joists, stretching screening, and planking and decking boats. It's priced at $6.75 by R. M. Products, of Rochester, Mich.

Drilling News



Radial Drill Press Tilts on Column

THIS flexible drill press, manufactured in Melbourne, Australia, can be swung to convenient positions for angle drilling. The horizontal column has a graduated collar on it for correctly setting the angle.

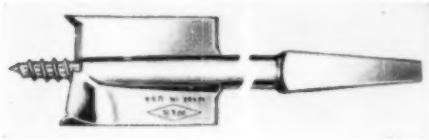
Drills Inserted in Shank

INSERTS from 9/16" to 2½" in diameter—like those shown at left—can be locked in shanks from 3" to 24" in length to give you a variety of drills for wood or metal. Any insert fits any length shank. Shanks are ½" in diameter except a 3" shank that is turned to ¼" on one end for use in ¼" electric hand drills.

The producer, W. W. Williams Industries, of Athol, Mass., also makes routers and shapers that are locked in a shank for use in a drill press or portable router. Prices range from 90 cents to $5.

Bit Resharpened with File

ONE of the features of a new auger bit (below) is that it can easily be resharpened with a flat file or grinding wheel. It comes in 14 sizes from ⅜" to 1¼". Prices run from 70 cents to $1.55. The maker, Whitman & Barnes, Plymouth, Mich., says it drills 25 percent faster than standard bits.



Increases Capacity Of Electric Drill

THE attachment pictured here makes it possible for any ¼" electric drill to bore up to a ½" hole. Reduction gears in the unit reduce the speed to a fifth of the normal speed, greatly increasing the torque delivered to the ½" chuck. In operation, the ¼" knurled shank on the attachment is chucked in the drill. Attachment and drill are then operated as an ordinary electric drill. The maker, G. M. Co. Manufacturing, Inc., New York City, prices the attachment at $12.50.

Gears Give You Two Speeds

BY USING low speed you can safely drill large holes in wood or steel with the drill shown below. With a full load the drill's speeds are 275 r.p.m. and 550 r.p.m. Capacity in steel is ⅜" at low speed and ⅜" at high speed. Capacity in hardwood is 1¼" at low speed and ⅞" at high speed.

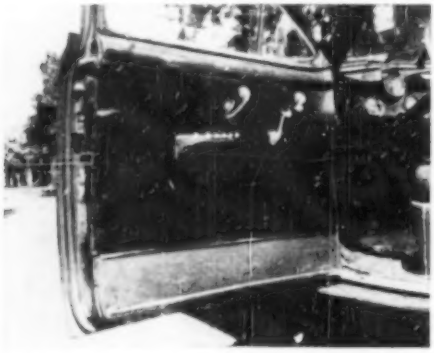
Other features of the tool, made by the Louisville Electric Mfg. Co., Inc. of Louisville, Ky., include a universal motor available for 32, 110, or 220 volts and an adjustable rocker ring for correct setting of the brushes. The price is $105.

Ice Cubes Lick Christmas Cards for You

If it's your tongue that takes the licking when you have a stack of Christmas cards to stamp and seal, try using ice cubes instead. As they melt, you'll always have a wet surface ready for moistening stamps or flaps.—*Mary Fulker, Monument, Colo.*

Plastic Hides Worn Car-Door Fabric

When the fabric on your car door becomes torn or badly worn, the easiest repair is to cover it up. You can do this with a product called "Cov-Ra-Door," a piece of sheet plastic shaped to fit the door and held in place by clips and the door handles. Made by A. N. McCreight, of DuBois, Pa., the covers are sold for about $4.50 a set and come in a selection of ten colors. The same company also makes clear plastic covers that protect the original fabric on new cars and allow it to show through.



Ball Bearings Will Mix Paint in Can

Here is a quick and easy way to stir paints used frequently in small amounts. After the can is opened and the paint thoroughly mixed, drop a dozen or more steel balls from a discarded bearing into the can.

To get a smooth mix thereafter, just shake the can vigorously before you paint.

Shop Broom Carries a Scraper

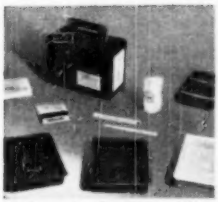
A push broom will do double duty around garage or shop if a scraper made from ⅛" by 1" strap iron is attached. Center the scraper on the broom and fasten with wood screws. It should be changed to the opposite side when the handle is changed.—*J. Lucas and H. Hiatt, Michigan City, Ind.*

Small Glue Packets Save Time

For those quick jobs where it's not convenient to get out the glue pot, U. S. Plywood Corp., of New York City, now puts up its Weldwood powdered resin glue in small measured packets. Each unit has three tear-off sections, the contents of which, mixed with half a teaspoon of water, provide enough glue for the average small fix-it job around the house. Proper consistency is easy to get without waste.

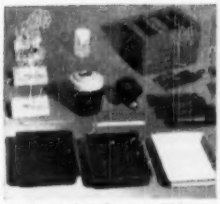
Coffee Makes a Clean Sweep on Floor

Confronted with a basement cleaning job and having no sweeping compound, I salvaged the morning's still-moist coffee grounds. Spread on the floor, they held down dust and freshened the air with a mild coffee aroma.—*Edwards Rogers, Columbus, Ohio.*

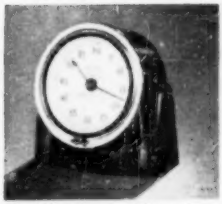


Kodacraft Printing Kit—everything you need to print pictures—$4.50

Kodacraft Photo-Lab Outfit—basic essentials for developing and printing—$7.95



Kodacraft Advanced Photo-Lab—complete developing, printing equipment—$13.50

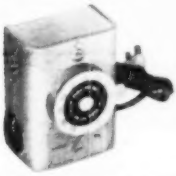


Kodak Timer—tilting base, sweep second hand, large, easily legible dial—$6.75

Kodak Hobbyist and Flurolite Enlargers—cool fluorescent lamp, "integrating-sphere" lamphouse. Hobbyist (left)—$49.50 complete. Flurolite (right)—$112.50 without lens.

Kodak Automatic Tray Siphon—converts tray to efficient print washer—$5.25

Kodak Utility Footswitch—frees both hands for handling equipment and materials—$10



Kodak Electric Time-Control—automatically controls printing time, 1 to 57 seconds—$13.50

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Kodak Flasholder, Model B—for cameras with flash-synchronized shutters—$11.50

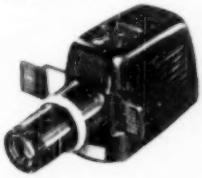
Kodaslide Compartment File—compartments hold 240 cardboard slides—$3.75

Kodak Turn-Tilt Tripod Head—for panning, tilting with most tripods—$15.46

Kodak Combination Lens Attachments—extend the scope of any camera.

Kodak Service Range Finder—split-field type; from 2 feet to infinity—$14.58

Kodaslide Table Viewer, 4X—projector, screen combined in single unit—$47.50



Kodaslide Projector, Model 1A—projects bright images up to 7 feet wide—$29.50

Kodaslide Projector, Model 2A—Lumenized Kodak Ektanon Lens, 5-inch f/3.5—$49.50

Kodaslide Table Viewer—famous Model A—$95

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Gus Fixes the Local Scrooge

[*Continued from page 176*]

the obvious things, including the great Mr. P's pocketbook." Gus admitted. "But there's an off chance that the carburetor could be the culprit."

With that the veteran mechanic slid in behind the wheel, turned the ignition key, and pushed the starter button. The engine ticked off immediately. Then Gus tramped down hard on the gas pedal, pushing it down to the floorboards. The engine took it without a balk or a splutter. Next, he idled it down and let it run awhile. There wasn't the slightest sign of a roll or a gallop or of choking up.

Could It Be Ignition?

"Well, there's one good hunch shot," he said as he got out of the car. "Might have known it wouldn't be that simple."

"What next?" Stan asked.

"I've a feeling it's probably some quirk in the ignition system, since the carburetor seems to be okay. Bring over the tester and we'll start by checking the new parts that the boys over in Evansville put in."

Methodically Gus went over the coil, the condenser, and checked the timing. He inspected the distributor. Everything seemed as it should be.

"Guess this isn't my day for hunches." Gus admitted, shaking his head. "I'll check the starter, and if that isn't it I guess the best thing we can do is just let 'er sit for a couple of hours. Then we'll watch for symptoms when we try to start 'er again."

Stan watched as Gus operated the starter, using the solenoid under the hood. A faint smile began to spread over Gus's mouth.

"Something wrong with the starter?"

Or Is the Starter the Clue?

Gus shook his head. "No, but come over here and see if you hear the same thing I do. Stick your head down under the hood there while I run the starter."

Stan did as directed and Gus pushed the starter button.

"Hear anything?" Gus asked.

"Yeah, sortuva bubbling sound, like water," Stan agreed.

Gus walked around to the front of the car and unscrewed the radiator cap. "Now, hit that starter button again."

As the starter ground, Gus watched.

"Okay, cut it," Gus called after a few

[*Continued on page 230*]

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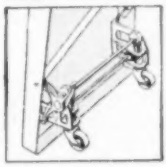

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* IDAHO WHITE PINE
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Gus Fixes the Local Scrooge

[*Continued from page 226*]

seconds. "Seems to be an awful lot of circulation in that radiator—more than most water pumps can put out. Let's try something."

Loosening the generator bracket, he slipped the fan belt off.

"Now hit that starter button once again," Gus directed as he peered down into the radiator filler opening again. "There's water circulation even when the pump is disconnected," he called, signaling for Stan to take his finger off the starter button. "Now we're getting someplace."

Cracks in the Head Gasket

"What does that show," Stan asked, "a leaky head gasket?"

"It does unless my third hunch is wrong," Gus agreed. "Here, give me a hand getting this head off."

After they had lifted the head off and placed it on the bench, Gus pointed to small cracks in the head gasket and signs of water seepage into four of the cylinders.

"There's our trouble." Gus pointed to small droplets of water. "Put in a new head gasket, Stan, and I think Mr. Purcell's hard-starting troubles will be over."

"Gus," Stan said as he tightened the last of the cylinder-head bolts, "I still don't see how water leaking into the cylinders could have caused the trouble. And if it did, why didn't it show up in other ways?"

"That's my fourth hunch for the day," Gus admitted with a grin, "but I'm more than sure of this one. I reckon it this way. There wasn't enough of a gasket leak there to cause compression loss, but there was enough of a leak to allow a little bit of water to seep into those four cylinders when the engine hadn't been run for two or three hours. Every time Purcell tried to start his engine under those conditions, the little water in each cylinder would foul the plugs."

Stan Gets the Answer

"But what about it starting when he got someone to push him?"

"After several blocks of pushing, the cylinders were able to clear themselves," Gus explained. "Then the engine would catch.

"On the other hand," he continued, "while the engine was still hot, any water

[*Continued on page 232*]

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Dear Folks:

You can save yourself some dough and maybe get out from under a big repair bill if you'll drive right down to your motor specialist and ask to see his Danger Zone Book.

This book takes all the mystery out of car repairs—shows what the parts look like, what they cost, what the charge for installing them will be. And—most important—the book shows what you can save by having repairs done when first needed.

If you'd like to have a special edition of this Danger Zone Book to study in your own home, just send a postcard or letter to DANGER ZONE, HASTINGS, MICHIGAN. There's no charge. Just say: "Send me your Danger Zone Book."

Tough Guy

WARNING ZONE

Engine loses pep . . .

Needs a tune-up

Clean, adjust and re-time ignition. Clean fuel supply and carburetor screens. Adjust carburetor. Adjust tappets and fan belt. Check compression and vacuum readings for symptoms of ring wear.

DANGER ZONE 1

Engine begins to smoke . . .

Needs new piston rings and minor engine repairs

Replace piston rings. Align rods. Adjust rods or replace rod bearings. Reseat and reface valves.

Tune engine.

These repairs are comparatively inexpensive and put the engine back in peak condition for thousands of economical miles. Delay puts the engine in Danger Zone 2.

DANGER ZONE 2

Engine pumps oil badly . . .

Needs new piston rings and major engine repairs

Replace piston rings. Replace piston pins. Adjust—probably replace—main bearings. Align rods. Adjust rods or replace rod bearings. Reseat and reface valves. Tune engine.

These repairs naturally cost more than those needed in Danger Zone 1, but they put the engine back in condition for thousands of additional miles of satisfactory service. Delay leads to costly Danger Zone 3.

DANGER ZONE 3

Destructive wear sets in . . .

Needs new piston rings and complete overhaul

Repairs cost three or four times as much as in Danger Zone 1.

Remove engine. Rebore cylinders. Replace pistons, pins, rings. Replace main bearings. Align rods, refit or replace rods, or replace rod bearings. Overhaul valve lifters, rocker arms. Replace timing chains or gears. Reseat, reface valves. Replace guides and springs. Replace camshaft bearings. Clean oil lines. Overhaul oil pump.

Clean, re-install and tune engine.

HASTINGS

MANUFACTURING COMPANY
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STEEL-VENT PISTON RINGS

GET YOUR CAR OUT OF THE
DANGER ZONE
THE MORE YOU DELAY
THE MORE YOU PAY!

Gus Fixes the Local Scrooge

[*Continued from page 230*]

that seeped in would vaporize. Then there'd be no shorting out of plugs and the engine would start with the starter."

Gus was busy on another job when Purcell walked into the repair shop at about five-fifteen.

"Got my car ready?" he boomed.

"Right over there," said Gus, pointing with a wrench.

"Fix it?" asked the big man as the two walked across the garage.

"Well, I think your starting troubles are over, Mr. Purcell."

Purcell slid behind the wheel. "Sure you fixed it now?" he asked suspiciously.

"Try her yourself. She's been sitting here cold for more than three hours."

Purcell grunted and pressed his foot on the starter. The engine caught immediately. "That's more like it," he said, almost pleasantly. Then he soured up again. "What're the damages?"

"Twenty-five dollars," said Gus. "And if it isn't really fixed, bring it back."

The Big Shot Balks but Pays

"You certainly aren't cheap," blustered Purcell, pulling a roll of bills out of his pocket and peeling off two tens and a five. "But if you've fixed it for good, I guess it's worth it.

"And here's that bonus I promised," he added, reluctantly peeling off another ten and handing it to Gus.

As Purcell's car disappeared down the highway, Stan said, "You did two things just now I've never seen you do before—overcharge and accept a tip. How come?"

In reply, Gus handed Stan the letter he'd been reading earlier in the afternoon. Then he said, "Purcell doesn't know it, but he's just made his first contribution to charity."

Stan looked at the letter. It was a Christmas appeal from the local orphans' home asking for money to help pay off the mortgage.

"And guess who holds that mortgage?" Gus asked with a wink. END

Pump Brakes to Stop on Ice

When you must stop your car on an icy road, alternately apply and release the brakes. Driving tests made on a frozen lake by University of Wisconsin engineers showed that friction between tires and ice is highest at moment brakes are applied.

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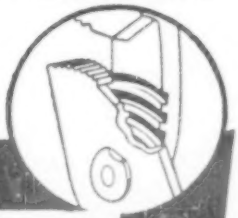
Channellock pliers are listed in the Yellow Pages of most Telephone Directories under "Tools"



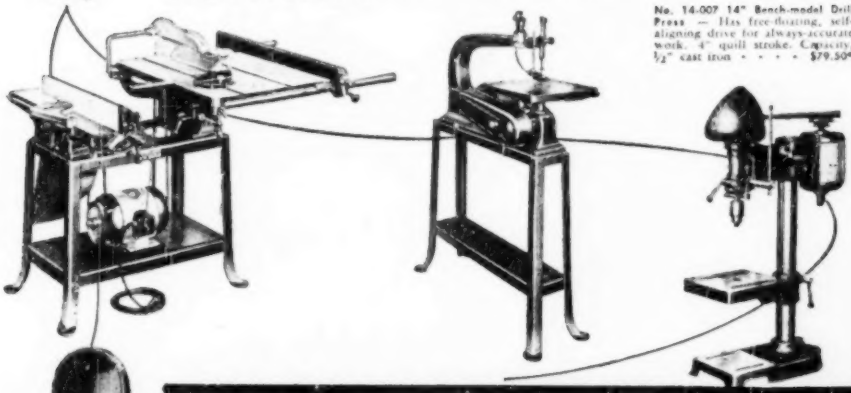
ONLY Champion DeArment makes

CHAN NEL LOCK

No. 27-595 Saw-Jointer Combination —6" jointer. 10" tilting-table saw. Cuts 3¼" stock. Rips to center of 50" panel. Joints ½" deep by 6" wide • • • • • $259.00*

No. 40-305 24" Scroll Saw — The smoothest-running saw you can buy. Cuts up to 1¾" thick. Table tilts left, right, front • • • $102.45*

No. 14-007 14" Bench-model Drill Press — Has free-floating, self-aligning drive for always-accurate work. 4" quill stroke. Capacity, ½" cast iron • • • • $79.50*



Whatever power tool you need . . .
DELTA'S YOUR BEST BUY

for safety, accuracy, dependability—at a price to fit every budget

Delta gives you better selection, a better price, and *quality* that means extra value every time.

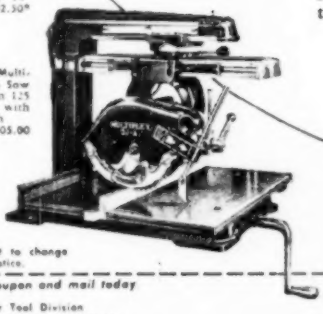
In the past 25 years, thousands of satisfied users in schools, industrial plants, commercial shops, and home workshops have come to know Delta tools as the last ones in the shop to need replacing.

Anything *less* than *Delta* quality usually costs *more* later — in maintenance, repairs, replacements. Don't risk this. Decide on Delta!

See your Delta dealer. Send for new catalog today.

No. 28-205 14" Band Saw—Takes 6¼" under guide. 80¼" blade to frame. 14" x 14" table tilts 45° right, 10° left • • • $162.50*

No. 20A Delta Multi-purpose Radial Arm Saw —Does more than 125 jobs! Complete with motor and switch • • • • $205.00



*Motor and switch extra.

All prices subject to change without notice.

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TWO MODELS
No. 1950-H (with precision hand-operated chuck) ONLY $17.95
No. 1950-G (with precision gear chuck) ONLY $19.95

- Tops in Quality
- Right in Price
- Built to Last

Want power and speed, easy action, and durability in a drill that does just about everything? Then get the feel of this streamlined Zephyr! Weighs only 3 lbs. 2 oz. but it's husky for work; engineered for accuracy and long tool life. Fan-cooled 110-120 volt motor delivers 1000 rpm. with full load; 1600 rpm. with no load. Cutler-Hammer trigger switch. Housing, handle, gear case of die-cast aluminum. U. L. listed. Attachments (available at extra cost) make it a work saver on scores of jobs—sanding, polishing, buffing, grinding, sharpening.

Portable Electric Saw

ZEPHYR MODEL 625
$39.95 COMPLETE

The portable saw with all the features! Cuts to 2¼". Adjusts 90° to 45°. Balanced for easy, one-hand operation. AC-DC motor 115-120 volts.

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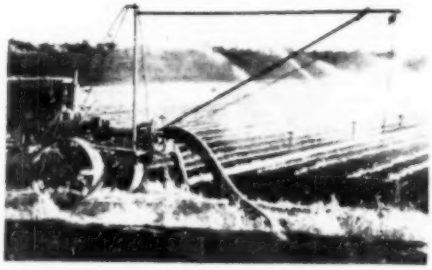
Mechanics of Farming

By Ladd Haystead

■ Two arms like shears, pivoted in the middle, a spring to hold the jaws closed, a cow's tail between pads on the jaws, and you have a mechanical solution to one of the world's oldest problems--keeping a cow's tail from batting the milker in the face. It's patented.

■ The use of thyroprotein in dairying, reported in this column last spring, is questioned by the Ralston Purina Co., famed makers of cow feeds. The cow's heartbeat and the rate of breathing is increased as much as 25 percent, says Ralston: "Until further experimental work is done . . . the dairyman who decides to feed thyroprotein is taking quite a gamble."

■ From all parts of the nation comes news of the installation of portable irrigation systems. Once used only on arid land, the technique is now being tried in humid areas, since rain, while it may be plentiful on an annual basis, is very likely to come at the wrong time or not at all when a crop needs it. The illustration shows an International Harvester U-6 power unit, mounted on a steel wagon, at work south of Lake Okeechobee, Florida, on a drained muck-land farm. It is providing overhead irrigation for newly planted



celery through 5-inch portable pipe placed in rows 600 to 1,200 feet long.

■ "Systemic entomology" is another new farm word from Texas. It means

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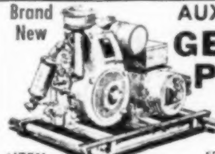
Brand New



(ITEM #88)

AUXILIARY ELECTRIC AC GENERATING PLANT

For General Utility and Emergency Use

2500 watts • 115 volts A.C. 60 cycles

Plenty of current to operate your: Oil Burner, Sump Pump, Refrigerator, Home Freezer, Power Saw, Lights, Radio and Television, Home Water System Pumps.

Complete integrated heavy duty electric power plant, Signal Corps Model PE-75, driven by Briggs & Stratton, one cylinder 6½ H.P. Model ZZ 4-cycle engine with killer button, oil bath air cleaner, governor, muffler, starting rope, and radio interference filter. The self-excited Leland or Westinghouse generator is rated 2500 Watts, 115 Volts, 60 cycle A.C. single phase, belt driven, with guard and duplex receptacle. When generator is not in use, you can use the engine separately to power other equipment. Mounted on adjustable steel skids, notched for carrying poles. Net wt. 310 lbs. Shpg. wt. 440 lbs. Dimen. 36" x 19½" x 24". 12 month guarantee. $726.00 value. NOW **295.00** F.O.B. Chgo.

DIRECT CURRENT GENERATORS

For welders, plating, truck and marine use, D.C. appliances, lights, etc. Aircraft quality—lifetime grease sealed ball bearings. Heavy duty.

Item #89—Type M-2, rated 50 Amps.—24 Volts. Mfd. by Leece-Neville Co. Shpg. wt. 32 lbs. Gov't. Acq. Cost $176.00. F.O.B. Chicago......NOW ONLY **16.50**

Item #90—Type P-1, rated 200 Amps.—28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov't Acq. Cost $300.00. Shpg. wt. 70 lbs. F.O.B. Chicago.......... **22.50**

Item #91—Type R-1, rated 300 Amps.—30 Volts. Mfd. by Jack & Heintz. Gov't Acq. Cost $380.00. Shpg. wt. 70 lbs. F.O.B. Chicago.......... **35.00**

Each individually packed in sealed box.

D.C. GENERATOR for 12 Volt Systems

Item #99—BRAND NEW. Rated 15 Volts at 50 Amps. Use on 12 Volt circuits on trucks, tractors, ships, planes, battery chargers, auxiliary lights, etc. Base mounting with 4 bolt holes ⅜" threaded shaft with keyway. Mfd. by Bendix-Eclipse. Gov't. acq. cost $136.00. Shpg. wt. 53 lbs....... F.O.B. Chicago **21.50**

UTILITY PUMP ROTARY VANE TYPE

Perfect For Water, Oil or Insecticides

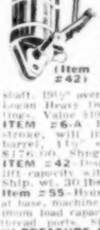
(Item #51)

Sprays DDT, 2-4D, sulphur compounds, etc. Pressures to 150 lbs., 15 gals. per min. at 1200 RPM using 2 HP. As vacuum pump for milking machines, lab use, etc., delivers 26" vacuum. 4.5 cu. ft. per min. at 1500 RPM, using ¾ H.P. Rotate either direction. ½" pipe thread ports, ⅜" standard shaft, 4 ball bearings. Easy to mount. Ready to run. Shpg. wt. 13 lbs. F.O.B. Chicago.......... **16.50**

Hydraulic Cylinders—Air or Oil

Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient, smooth pressure hydraulics on presses, arbors, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc., etc.

Item #70—Purolator hydraulic oil filter. Permanent element type, ⅜" female pipe thread ports. Capacity, 16 gallons per minute. A $13.00 value. Now.......... **Postpaid 4.95**



(Item #42)

ITEM #4—All steel double action hydraulic cylinder, 1¼" bore, 2½" stroke. Clevis mounting. Will lift 1000 lbs. with 1000 P.S.I. line pressure. Perfect for positioning and feeding movements. Shpg. wt. 4 lbs.......... **Postpaid 4.95**

ITEM #33C—Double action hydraulic cylinder, 1½" bore, 4½" stroke. Clevis mountings at both ends. Uses ⅛" pipe fittings.......... **Postpaid 8.95**

ITEM #32—Double action, 1½" bore, 9" stroke, will lift 1760 lbs. with 1000 P.S.I. line pressure. Wt. 4 lbs. A $15.00 value. **Postpaid 10.95**

ITEM #41—Double action hydraulic cylinder, 2" bore, 6" stroke, clevis mounting at base and end of shaft. Overall length closed 17½". Has ⅝" stainless steel shaft, uses ⅛" tubing fittings. Will lift up to 3100 lbs. with 1000 P.S.I. line pressure. Weight 7 lbs. **Postpaid 12.50**

ITEM #15—Double acting cylinder, 3" bore, 10½" stroke. All steel hydraulic cylinder, will lift up to 7000 lbs. with 1000 P.S.I. line pressure. Wt. 12 lbs. A $28.00 value. **Postpaid 19.50**

Item #31C—Double action hydraulic cylinder, 3½" bore, 11" stroke. Aluminum alloy cylinder wall and all steel 1⅛" diameter piston rod. Clevis mounting at base and shaft. 19½" overall length closed. Will lift 9625 lbs. using 1000 PSI from Logan Heavy Duty Hydraulic Pump. Uses ⅜" tubing fittings. Value $102.00. Shipping wt. 11 lbs. F.O.B. Chicago **22.50**

ITEM #6-A—Double action hydraulic cylinder, 3" bore, 25" stroke, will lift 7070 lbs. with 1000 PSI line pressure. Steel barrel, 1½" stainless steel shaft. Gov't acq. cost $176.00. Shpg. wt. 26 lbs. **F.O.B. Chicago 28.00**

ITEM #42—Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 P.S.I. line pressure is 12,500 lbs. Ship. wt. 30 lbs. **F.O.B. Chicago.** An Excellent Buy for **32.50**

Item #55—Hydraulic cylinder, 6" bore, 60" stroke, with flange mounting at base, machine thread at shaft end. Working pressure 1,000 P.S.I., maximum load capacity, 28,000 lbs. This cylinder has ¾" pipe thread ports. Shipping weight 263 lbs. F.O.B. Chicago **75.00**

HI-PRESSURE FITTINGS for cylinders and valves available at 50c ea. for ⅜" pipe and 65c ea. for ½" pipe.

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D. C. ARC WELDER

250 AMPS. MODEL 252

FOR ANY WELDING JOB, LIGHT OR HEAVY

Stop Costly Repair Bills, Weld It Yourself and Save

(Item #65)

Only one or two jobs will pay for entire welder.

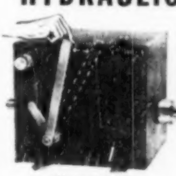
Designed for many years of trouble-free service. This precision engineered Direct Current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly where and when you need it. Has dial type rheostat for easy pinpoint control and a high-low range switch. Run welder at 2500 RPM from drive pulley or power take-off of tractor, a 7½ HP electric motor or a 10 HP gas engine. Use two V belts or flat belt (on pulley).

Now ... AT A FRACTION OF ITS VALUE. Price includes double V or flat belt pulley and instruction book. Shpg. wt. 107 lbs. F.O.B. Chicago.......... **99.50**

ACCESSORY KIT including welding helmet, electrode holder, two 10 ft. cables with clamp and 5 lbs. of assorted welding rods. (ITEM #66)..........Shpg. wt. 17 lbs. F.O.B. Chicago **10.50**

If more information is desired write for welder circular.

FINGERTIP SPEED CONTROL HYDRAULIC TRANSMISSION



(Item #115)

Variable output speeds ranging from 0 to input speed now available. Merely move control handle until desired speed is attained. Then turn locking handle to maintain the setting. Internal relief valves prevent overloading. Use input power of ¼ to 1½ H.P. Use for: reamer drives, midget cars, feed mills, canning machines, conveyors, lathes, milling machines, motor boats, cream separators, garden tractors, pumps, blowers, etc.

This Westinghouse-Oil Gear Unit converted to commercial use from 40 MM anti-aircraft traversing mechanisms consists of a variable displacement hydraulic pump feeding a fixed displacement hydraulic motor. These components are contained in a crackle-finish steel oil reservoir (capacity 2 qts.). Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds.

Independent reverse control allows full output power and speed selection in either direction of rotation.

Both input and output shafts measure ⅝" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speeds not to exceed 750 R.P.M. Overall dimensions: 7½"x7½"x11½". Gov't. acquisition cost, $428.00. Shipping weight 26 lbs. Complete with 2 qts. of oil and full instructions.......... **Postpaid 54.50**

LOGAN HEAVY DUTY

HYDRAULIC PUMP

(Item #29)

For operating hydraulic cylinders and hydraulic motors on tractors, bulldozers, construction machinery, lift trucks, industrial applications, etc. Delivers 10 GPM at 1200 RPM at 1000 P.S.I. using 6 HP. Has a ¾" inlet, ½" outlet, ¾" shaft with flat and keyway for direct or pulley drive. Has flange with 4 bolt holes for convenient mounting. Ship. wt. 22 lbs. Overall dimen.: 7" L x 5½" H x 5½" W. A $105.00 value FOR ONLY F.O.B. Chicago **22.50**

HYDRAULIC CONTROL VALVES

(ITEM #24)

ITEM #24. Four-way control valve with built-in relief valve, for use with one double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders. Ship. wt. 8 lbs. A $38 value. **postpaid 9.95**

ITEM #26. Four-way control valve for use with two hydraulic double-action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Ship. wt. 6 lbs. A $60 value. **postpaid 12.95**

HAND HYDRAULIC PUMPS

Used for hydraulic jacks, presses, hoists and other hydraulic applications. For operating hydraulic cylinders to pump oil or hydraulic fluid under pressure.

(Item #83)

Item #11—Hand pump has built in check valve and is capable of delivering 1000 lbs. of pressure. Has alloy aluminum housing. Dimen: 8" long x 3½" high x 2¾" wide. Ship. wt. 3 lbs. A $42.00 value complete with handle NOW.......... **Postpaid 8.95**

Item #83—Hand hydraulic pump with built-in transfer valve. As illustrated. **Postpaid 12.95**

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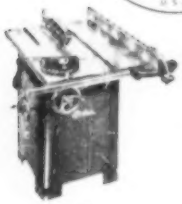
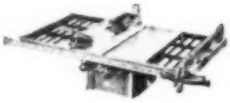
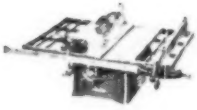


Atlas
10" FLOOR SAW
NO. 3170

Atlas
10" FLOOR SAW
NO. 3160



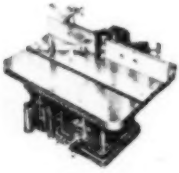
Atlas
10" BENCH SAW
NO. 3060



Atlas
8" BENCH SAW
NO. 3020

Atlas
12" BAND SAW
NO. 912

Atlas
BELT and DISC SANDER
NO. 5010



Atlas
SPINDLE SHAPER
NO. 3500

POWER KING
SPINDLE SHAPER
NO. 411

Atlas
15" FLOOR DRILL PRESS
NO. 1060

Atlas
15" DRILL PRESS
NO. 1020

Atlas
12¾" DRILL PRESS
NO. 1010

POWER KING
11¾" DRILL PRESS
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Whatever kind of work you want to do in your shop — woodworking, metalworking, or plastics machining — there's an Atlas or Power King tool to meet your needs *precision engineered and built to industrial quality standards!*

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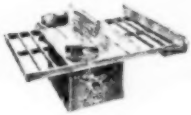
POWER KING TOOLS

for Your Shop Ever Produced by One Manufacturer!

POWER KING
8" BENCH SAW
NO. 3102



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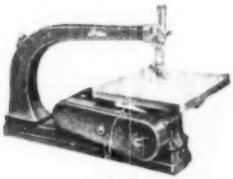
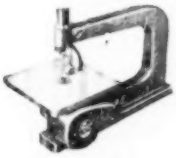
NO. 6000

POWER KING
4" JOINTER-PLANER
NO. 6050



Atlas
24" JIG SAW
NO. 4021



POWER KING
18" JIG SAW
NO. 4010

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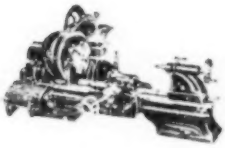
12" WOOD LATHE
NO. 7122

POWER KING
9" WOOD LATHE
NO. 7090



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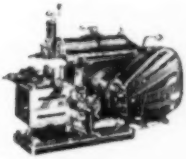
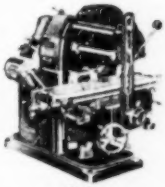
NO.. QC42

Atlas
6" LATHE
NO. 618



Atlas
7" SHAPER
NO. 7B



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Please send catalog of ☐ Atlas woodworking tools ☐ Atlas metalworking tools ☐ Power King woodworking tools.

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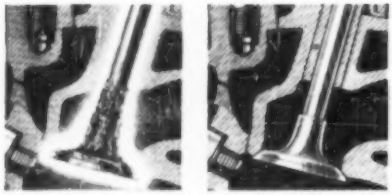
Why won't it start?

Oil congeals in cold weather, gets stiff, ties up your motor so it can't start.

Casite guarantees Quick Starting in Coldest Weather or Double-Your-Money-Back. Casite retards congealing of oil, lets your motor spin over and start, no matter how cold the weather.

Why *does* it jerk?



Chances are, your trouble is sticky valves.

Casite frees sticky valves and rings . . . gets rid of gum and goo . . . conditions your car for winter driving. Casite guarantees Better and Smoother Motor Performance or Double-Your-Money-Back.

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Your garage, service station or car-dealer will give you a Casite Treatment — 75¢ a pint (95¢ in Canada). You'll get smoother, happier driving for many miles to come. The Casite Corporation, Hastings, Michigan. Casite Division, Hastings Ltd., Toronto.

QUICK STARTING IN COLDEST WEATHER

or Double-Your-Money-Back

putting poisons for killing plant pests in the soil at time of planting. The poison is taken up by the plant, killing the bug that strives to get a meal from the plant. Octamethyl pyrophosphoramide has shown good promise when as little as one-fifth pound to the acre was applied at cottonseed-planting time. It took care of aphids and red-spider mites for two months.

■ The University of Illinois comes up with a cure for chicken-eating hogs: lay a chicken carcass on a board, hook one wire from an electric fence controller to the carcass and ground the other wire--and then invite the hog to try it.

■ Pellet range seeding has not lived up to its widely publicized promise, according to Donald M. Barnard, University of Wyoming. Airplane-sown pellets have not penetrated the range soil; rodents still eat them; germination has been lowered by some of the processes used; and satisfactory stands of range grasses have not been obtained. At least 150,000 acres in five states have been seeded but the results were unsatisfactory, the investigator says. Comment: This reporter, some readers may remember, was one of the publicists who started the "widely publicized promise" in another national magazine, but he stated what the experimenters would try to do, did not "promise" results.

■ Sooner or later someone was bound to come up with the term "atomic farmer." University of Chicago was first under the wire in announcing a Ph.D. would be awarded to Aaron Ganz, Atomic Energy Commission fellow, for his work in growing tobacco plants successfully in air containing radioactive carbon dioxide. The nicotine was extracted from the plants and injected into the bodies of animals. This made it possible to trace what happens to nicotine in the body. Nicotine is gotten rid of through urine, but none is given off through the lungs. Nicotine has long been known to have a peculiar affinity for the heart, but Ganz's experiments indicate there may be some means by which the heart can protect itself against the effect of nicotine.

SURPLUS MACHINE SHOP TOOLS

HIGH SPEED MORSE TAPER SHANK DRILLS

Set 1H 15 Different Size High Speed Morse Taper Shank Drills up to 9/16" with No. 1 and 2 tapers. $50 value. Priced at only..... **$6.49**

Set 2H 20 Different Size High Speed Morse Taper Shank Drills from 1/4" to 1". $70 value. Priced at only..... **$12.95**

Set 3H 10 Different Size High Speed Morse Taper Shank Drills from 1/2" to 1 1/4". $50 value. Priced at only **$9.95**

Set 4H 10 Different Size High Speed Morse Taper Shank Drills from 1" to 2" with No. 3, 4 and 5 tapers. $180 value. Priced at only..... **$39.95**

HIGH SPEED TAPER SHANK CHUCKING REAMERS

Set 5H 20 Different Size High Speed Morse Taper Shank Chucking Reamers up to 1/2" with No. 1 and 2 tapers. Priced at only **$6.95**

Set 6H 8 Different Size High Speed Morse Taper Shank Chucking Reamers from 1/4 to 1". Priced at only..... **$4.95**

Set 7H 10 Different Size High Speed Morse Taper Shank Chucking Reamers from 1/2" to 1 1/8". $65 value. Priced at only..... **$9.95**

Set 8H 20 Different Size High Speed Morse Taper Shank Chucking Reamers from 1/4" to 1". Priced at only **$9.98**

HIGH SPEED STRAIGHT SHANK CHUCKING REAMERS

Set 9H 20 Different Size High Speed Straight Shank Chucking Reamers up to 1". Priced at only..... **$6.95**

Set 10H 10 Different Size High Speed Straight Shank Chucking Reamers from 1/2" to 1 1/8". Priced at only **$9.95**

Set 11H 15 Different Size High Speed Straight Shank Chucking Reamers from 1/4" to 1". Priced at only **$6.95**

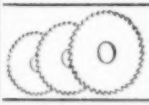
HIGH SPEED HAND TAPS

Set 12H 14 Different Size High Speed Standard Thread Hand Taps up to 3/4". Priced at only **$2.95**

HIGH SPEED MILLING CUTTERS

Set 13H 4 High Speed Milling Cutters. Set consists of two side milling cutters, size 2 x 1/8 x 5/8" arbor and two side milling cutters, size 2 x 3/16 x 5/8" arbor. Set of four priced at only **$3.95**

SLITTING SAWS



Set 14H 7 Different Size High Speed Slitting Saws 2 3/4" dia. x 1" arbor. Thickness from .040 to .071. Cuts wood, alumi-num, brass, steel, etc. $25 value. Priced at only **$4.95**

BRAND NEW HIGH SPEED COMBINATION DRILL AND COUNTERSINKS

Set 15H 8 Different Size from #2 to M1 (1/16 drill x 13/64 body to 7/32 drill x 3/8 body) 90 degree of counter-sink. These new countersinks sell new from 75c to $2.50 each. Your price for this set of 8, while this last, only **$3.95**

HYDRAULIC DEPARTMENT

BRAND NEW HYDRAULIC UNIT

Pesco 1P203 Gear Type Hydraulic Pump rated at 3 G.P.M. @ 3750 R.P.M. and 1000 P.S.I. Priced at only **$6.95**

Discounts on quantity.

#1500 Reconditioned PESCO HYDRAULIC PUMP

Gear type, rated 1500 PSI, 2 1/4 G.P.M. at 1500 R.P.M. 3/8" drive spline. No. 1P203 reconditioned guaranteed. Priced at only **$6.49**

Discounts on quantity.

FOUR-WAY HYDRAULIC VALVE

High pressure Adet valve for controlling one cylinder or other hydraulic equipment. 3/8" pipe ports. Heavy steel construction. Priced at only **$5.98**

Master Hydraulic Control Valve

Will operate 1 or 2 hydraulic cylinders independent of each other or together by means of 3 control handles. Rated at 1000 P.S.I. Valve made of heavy steel with standard pipe ports. Cost new over $125. Priced to you at only **$6.95**

Discounts on quantity.

Write for our catalog describing thousands of machine cutting tools, hydraulic equipment, etc.

All merchandise is sold with money back guarantee of satisfaction and is shipped postpaid unless otherwise stated.

T & T TOOL, 111 West Archer, Tulsa, Oklahoma

ADJUSTABLE **HOLLOW AUGER**

USUAL $7 VALUE **$2.00**

YES, We said $7 VALUE. CUTS TENONS or wheel spokes. Adjusts 1/4 to 1 1/4" Diam. Send cash, check or money order, plus 25c for mailing to

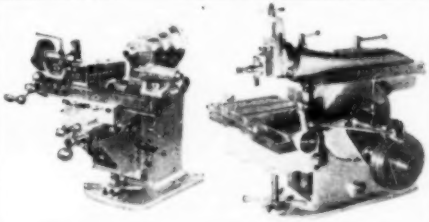
E. G. HOWARD, 89 Washington St., Boston 8, Mass.

Saw, Drill & Grind

without stopping, lifting machine or changing set-ups; only one change for lathe work and sanding. No heavy lifting. Basic Emrick 5-in-1 Machine still only $39.95. **10-day Free trial; Money-Back Guarantee.** Write for FREE Catalog of entire line.

EMRICK 5-in-1

EMRICK, INC., 2120 Clinton, Kalamazoo, Michigan



CASTINGS! Build your own machine tools

We supply the castings. Our machines especially designed for individual construction. Our catalogue with complete drawings of this Bench Milling Machine or Six Inch Stroke Shaper 25 cents per set postpaid. For full information send One Dollar for 20 sheets quarter and half full size complete construction drawings of three Millers, Shaper and Bench Lathe, accessories and attachments. Refund on castings order.

DAVID JONES MACHINE CO.

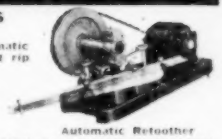
1828 Stratford Ave. Bridgeport, Conn.

Sharpen SAWS FOR PROFIT

RETOOTH HAND SAWS IN 60 SECONDS

Increase your income with automatic retoother that cuts 4 to 16 point rip or cross-cut teeth in hand saws.

Requires less space, less time and less effort ... while doing a perfect job. Gives a lifetime of service and has a 1 year guarantee. Free folder on request.



Automatic Retoother

EARN $6 AN HOUR WITH THE MOTOR DRIVEN BURR SAW FILER

Motor Driven Saw Filer

It does a better, faster and easier filing job. No time filing adjustments necessary ... the accurate operator controlled file arm will file from both sides. Gives a lifetime of service and has a 1 year guarantee. FREE FOLDER ON REQUEST.

WRITE FOR VALUABLE BOOK

Send 25c in coin for Burr's Blue Book of saw shop charges and other valuable information

SAW SHOP CHARGES Coast to Coast

BURR MFG. CO., Dept. 12, 8943 Venice Blvd., Los Angeles 34, Calif.

Make $20 to $30 a Week

EXTRA MONEY

MACHINE SAW FILING

PAYS UP to $2 or $3 an HOUR

• Turn your spare time into CASH—sharpening saws with a Foley Automatic Saw Filer pays up to $2 or $3 an hour. You will find you can make $20 to $30 a week in your spare time as a starter.

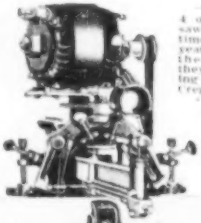
You can work in your basement or garage—no experience necessary. "The first saw I sharpened with my Foley Filer came out 100%"—writes Clarence E. Parsons. No canvassing—"I advertised in our local paper and got in 93 saws"—says M. L. Thompson. The Foley is the only machine with which you can file all hand saws, also band saws and cross-cut circular saws.

SEND FOR FREE BOOK

"INDEPENDENCE AFTER 40"!

Shows how you can get business from home owners, farmers, carpenters, schools, factories, etc. With a small investment, no overhead, no stock of goods to carry, you can get right into a cash business—and possibly later on develop into a full-time repair shop. Send coupon today for Free Book. No salesman will call.

"Each saw I filed got me six more and business has been picking up that way since a year ago. If it keeps up I will have to buy another Foley Saw Filer." William C. Baldwin



"I have done 4 or 5 thousand saws in my spare time in the 40½ years since I got the outfit, and they are all coming back." Len Crego

"Have filed over 2200 saws in 18 months—the customer always brings another." L. A. Fink

INDEPENDENCE after 40!

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Minneapolis 13, Minnesota

Send FREE BOOK—"Independence After 40."

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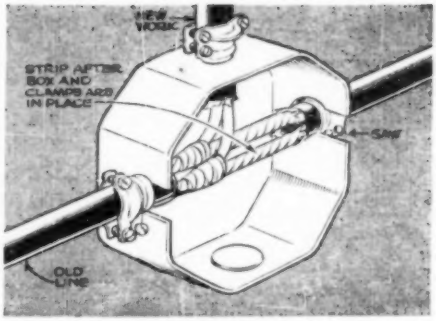
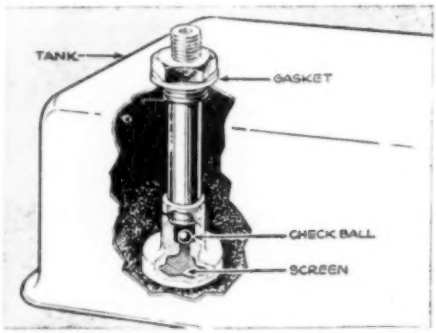


Adding New Junction Boxes

If you do any house wiring, you've probably been faced with the job of breaking in on an existing Romex or other soft-sheathed line to tap off a new branch. If the original line is tightly strung, cutting it for the new junction box shortens it so that it is impossible to splice without adding more wire.

One way to lick this problem is by adding the box without cutting the cable at all. Hacksaw slots from the outside edges of the box to the two side ports. Bend the slots open, and slip the box over the cable. Make the cable fast at each point of entry with a cable clamp of the side-opening type (such clamps are available for use with Romex cable). After the box and clamps are in place, you can strip the wire and add the new connections.—*Kenneth H. Cassens, Rockland, Maine.*



Plugged Screen Stops Engine

If a small air-cooled gas engine fails to run because it isn't getting gas, a plugged screen in the feed pipe assembly is a likely cause. Remove the assembly from the tank by unscrewing. Then soak it in alcohol. This removes gum, restores check-ball action.—*Marion L. Rhodes, Knightstown, Ind.*

FOR PLEASURE AND PROFIT IN SHOP AND HOME

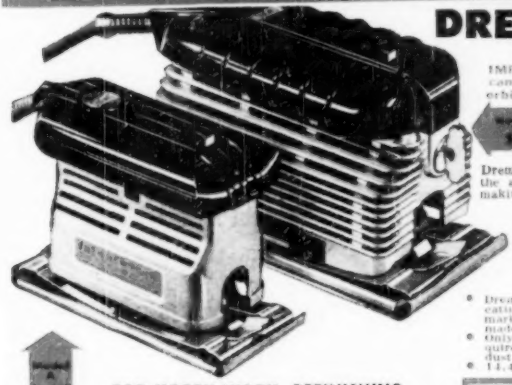
IDEAL CHRISTMAS GIFTS TO GIVE OR GET!

PRACTICALLY DESIGNED . . . ZAPPY OPERATED . . . QUALITY BUILT . . . FULLY GUARANTEED

DREMEL *Electric* SANDERS

STRAIGHT-LINE Action for Guaranteed SCRATCH-FREE Surfaces

IMPORTANT—Before you buy just any sander, remember you cannot get an absolutely scratch-free finish with rotary, orbital, or arc-type sanders.



Model 2000 $24.50

FOR HEAVY-DUTY CRAFT AND WOODWORKING PROJECTS

Dremel's new Model 2000 is a fast-cutting, production sander. It has the added stroke and extra power required for furniture and cabinet making, boat building or refinishing. Great for building operations, sanding woodwork, dry wall joints, siding and other surfaces. Does a superb wax polishing job, too. Weighs only 5 pounds yet has 21 sq. in. sanding surface. Over-all size 9¾" x 11½" x 7". Complete with steel carrying case, 25 asstd. sheets sandpaper, polishing pad..... **$24.50**

LOOK FOR THESE DREMEL FEATURES

(In Model A and Model 2000 Sanders)

- Dremel's Straight-Line Reciprocating Action leaves no sanding marks . . . removes scratches made by other type sanders.
- Only two moving parts . . . requires no oiling . . . sanding dust does not affect action.
- 14,400 cutting strokes per minute . . . assure faster sanding-polishing.
- Cam-type holder permits changing paper in seconds.
- S. B. Underwriter's approved cord . . . operates on 110-120 volt, 60 cycle A.C. . . . fully guaranteed.

Model A $14.85

FOR HOBBY WORK, REFINISHING AND REDECORATING . . .

Dremel Model "A" Sander is a time and labor saver for hobbyists, home-owners and housewives, over a quarter million now in use. Like Model 2000, its straight-line reciprocating action will not leave cross-grain scratches and abrasive marks made by other type sanders. Ideal for sanding woodwork, cabinets, unfinished furniture, workshop projects, etc. Weighs only 2½ lbs. Takes the drudgery out of polishing waxed surfaces—furniture, woodwork, etc. Sanding pad 2½" x 5½". Furnished with 6 sheets sandpaper, 1 sheepskin, 1 felt pad..... **$14.85**

DREMEL *Electric* COPING SAW

CUTS SCROLLS LIKE MAGIC—SANDS AS IT SAWS

JUST GUIDE IT!

Only $5.85 with Saw Blades

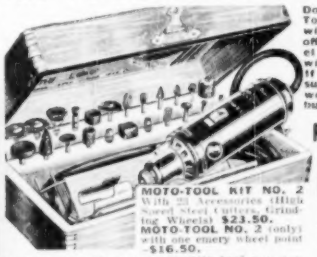
FREE PROJECT PLANS . . . for 6 useful projects packed with each saw never needs oiling. Uses 110-120 v. A.C.

SAFE! AS A HANDSAW

For home, hobby, repair work—no other tool pleases so much for so little cost. Works in any direction—delivers 7,200 strokes per minute smoothly, effortlessly. Saws through ¼" medium-hard wood at a foot-a-minute speed. Touch-of-the-trigger, foolproof action. Only 2 moving parts.

DREMEL MOTO-TOOL

THE POCKET-SIZE MACHINE SHOP



Don't confuse Moto-Tools and Accessories with so-called "bargain offers." Compare Dremel feature for feature with competitive tools. If our products are not superior in every way, we don't want you to buy.

MOTO-TOOL KIT NO. 2 With 23 Accessories (High Speed Steel Cutters, Grinding Wheels) **$23.50.**
MOTO-TOOL NO. 2 (only) with one emery wheel point **$16.50.**

Portable DRILL PRESS Only $9.95 (Less Moto-Tool)

Moto-Tool is the most versatile tool you can own—grinds, routs, drills, carves, engraves, polishes, etc. **Look at these features:** Approx. 27,000 R.P.M. ● Dynamically balanced armature eliminates vibration. Oilless (oil-sealed) bearings ● Dust-filtered air-cooling system ● Weighs 13 oz. ● Uses 110-120 v. AC ● Used in plants of General Electric, Ford, Remington Arms, Nash-Kelvinator, etc.

BIG VALUE!

MOTO-TOOL KIT No. 1

Moto-Tool Kit No. 1 contains the lighter Model No. 1 Moto-Tool and 34 practical accessories (steel cutters, grinding wheels, etc.) in an attractive, lacquer-finish wood case. It's the biggest value in the field. With 34 Accessories Only **$17.50**

MOTO-TOOL NO. 1 with one emery wheel point **$9.85**

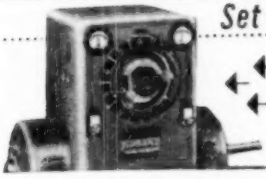
WHERE TO BUY DREMEL TOOLS

Dremel Tools are sold everywhere. If your dealer cannot supply you, send remittance in full and we will ship postpaid. Or send only $2. and pay postman balance plus postage and fee. **Money back if not delighted after 5 days' trial.**

DREMEL MFG. CO., Dept. 120-M, RACINE, WIS.

Set Up Your Own Welding Business—Save $300 to $500

Get Into Big Profits on Repair and Contract Work



"Build Your Own" big capacity arc welder and save! This HOBART generator plus your own hook-up builds a welder that will earn hundreds of extra dollars for you.

Let Hobart help you "build your own" welder and save $300 to $500 over cost of factory-built unit. Select the type and capacity generator you want from our complete line and belt or couple to a good used auto engine. Don't miss this opportunity. Write for FREE booklet.

HOBART HOBART BROTHERS CO., BOX P-120, TROY, OHIO

"One of the world's largest builders of arc welders"

FOR XMAS

A COMPLETE CASCO electric POWER TOOL KIT

for only $9.95

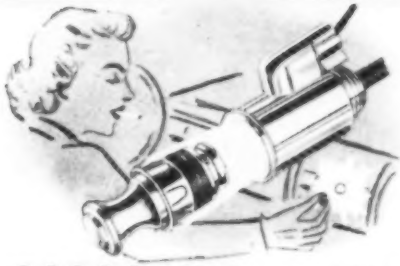
14 PIECES INCLUDING THE FAMOUS CASCO POWER HEAD

YEAR-ROUND JOY FOR MAN AND BOY!

The most practical power workshop any craftsman or hobbyist can own! It drills, grinds, buffs, polishes, sands, sharpens, etches, etc. All the accessories you need for working on metal, wood, glass, leather, plastic, fibre. 1001 year-round money-saving uses! Operates on AC and DC current. Fully GUARANTEED. Other Casco Power Tool Kits to $19.95. At Appliance, Department, Hardware and Jewelry Stores.

Write today for name of nearest dealer.

FOR A SAFER 'LIGHT' AT NIGHT



CASCO VIS-O-LITE

Illuminated Automatic

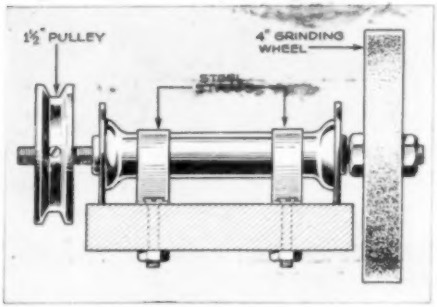
CIGARETTE LIGHTER

Why be without the convenience of this great new Vis-O-Lite illuminated lighter that makes driving safer day and night? You can replace your old lighter with a new Vis-O-Lite in a matter of minutes with pliers and screwdriver . . . and get the advantages of an illuminated lighter—well that ends fumbling in the dark, prevents scratching dashboards. Made by the manufacturers of the original pop-out lighter that's standard equipment on 4 out of 5 cars. Costs only **$2.75** complete. The illuminated well-assembly alone (minus the pop-out unit) costs only **$1.25.** Now on sale at Car Dealers, Auto Supply Stores and Service Stations.

CASCO PRODUCTS CORPORATION
BRIDGEPORT 2, CONNECTICUT
CASCO

Hand Viewer Holds 20 Slides

If you're in a hurry, you can see all 20 of the slides held by this new Multipix viewer in 20 seconds. And by sliding a button, you can go through them all again in their proper sequence. The device handles 2 by 2 transparencies in their original cardboard mounts, and an adjustable-focus lens magnifies five times. Paralex Instrument Co., of N. Y., sells it for $14.95.



Bike Hub Serves as Arbor

You can save yourself several dollars—as I did—by making an arbor for light grinding from the hub of a bicycle's front wheel. I secured the hub to a base with two steel straps, as shown in the sketch. On one end of the axle I mounted a 1½" pulley and on the other end I secured a 4" grinding wheel with two nuts.—*Joseph T. Bonner, Philadelphia.*

Snap-on* ARMATURE RECONDITIONING TOOL

does both

1 turns down armature

2 undercuts the mica

*Trade-mark of Snap-on Tools Corp.

Armatures reconditioned faster than on an expensive lathe — and the work is tops! Just clamp this tool in a vise and you're ready to go. Cuts controlled to the finest shaving. Pays for itself quickly—simple to operate. Handles everything that comes to the automotive garage.

SNAP-ON TOOLS CORP.,
8060-L 28th Ave.,
Kenosha, Wis.

ENCLOSED ☐ Money Order ☐ Check ☐ Company Purchase Order for $44.75 for Armature Tool. (For vacuum cleaner, fan, sewing machine and other small motors order Small Collet and Bushing ADAPTER SET, $10.50 extra). Add local sales tax.

NAME.....

ADDRESS.....

CITY.....STATE.....

Finest locking plier because...

Clamps on better with *patented swivel jaw* which adapts itself to shape being held. **Faster working** because of *patented jaw size indicator;* you pre-set jaw size to approximate size of object. **Easier opening** with *patented lock release;* finger-operated lever readily releases 2000 pound bite.

$1.95 7" size
10" – $2.50
Both bright nickel finish

At your dealer's. Send for FREE folder.

SEYMOUR SMITH
"Snap-Lock"
PLIER-WRENCH

SEYMOUR SMITH & SON, INC.
112 Main St., Oakville, Conn.
100 years of quality tools

SEYMOUR SMITH
The Line of Quality
SINCE 1850

"SAVE IT AND FIX IT"

MENDS

DISHES, FURNITURE, LUGGAGE

It's transparent, waterproof, flexible and durable. Get a tube today.

DUPONT
DUCO CEMENT
REG. U. S. PAT. OFF.

FREE get it Now—

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Save money on every Radio and TV need! Get the big 212-page 1951 ALLIED Catalog featuring the world's largest stocks of top-quality equipment at low, money-saving prices! See the latest TV releases, home radios, radio-phonos, Amateur equipment, P.A. systems and Hi-Fidelity Custom Sound, recorders, test instruments, builders' kits—plus thousands of parts, tools, books and diagrams. Get more for your money from the World's Largest Radio Supply House. Send today for your FREE new 212-page 1951 ALLIED Catalog!

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Address.....

City.....*Zone*....*State*.....

Want the Pure Stuff?

YOU can buy the purest sodium metal available, 99.95 percent pure, in bars an inch square and 10 inches long from a New York chemical dealer. A Cleveland plant will supply helium gas of 99.99 percent purity, sealed in glass bulbs. Small ampoules of liquid mercury as pure as 99.999 percent can be ordered from a London firm.

An unusual 77-page directory telling where to get materials of such purity was recently published by the Atomic Energy Commission. It is entitled, "AECU-222, Availability and Sources of the Ninety-Six Elements in High Purity Forms," and may be obtained for 30 cents from the U. S. Atomic Energy Commission, Document Sales Agency, P. O. Box 62, Oak Ridge, Tenn.

Its compiler, Elwin H. Covey of the University of California Radiation Laboratory, enlivens the directory with notes on his own efforts to get rare elements.

Hardest-to-find of any that he's sought to locate, he says, is thulium. In 1947 he placed an order with a leading dealer in rare chemicals. At last reports it was still "in preparation," which suggests the difficulty of isolating this rare-earth element.

Some scientists collect rare elements, he reveals. The collections of four men in this country and of three abroad—in England, Germany, and Italy—are the likeliest sources of such prized rarities as pure dysprosium, erbium, and europium.

For completeness the directory lists all 96 elements known at the time of compilation, in 1949, although some were completely unavailable. Others, like hafnium, were marketed only as compounds. However, a New

[Continued on Page 246]

NEW JIG SAW CUTS 1" WOOD with 50% MORE POWER and 70% LESS NOISE!

SYNCRO POWER UNITS
GUARANTEED
AGAINST BURN-OUT ALL DURING YOUR OWNERSHIP
or Replaced FREE!

Santa suggests the largest, most powerful, most versatile jig saw of its kind, yet *safe* for children—SYNCRO! The entire family will enjoy it. Now *70% quieter operation* with *50%* MORE POWER! Cuts *any* length 1" wood, thin metal, plastic. Precision-built to last a lifetime. Portable. Ideal for apartment use. Just plug in and saw. Not a "lumber" cutter, but for fine, delicate craftsmanship. ENTIRE SAW LISTED BY UNDERWRITERS' LABORATORIES, INC. *and* Power Unit GUARANTEED *Against Burn-Out* BY SYNCRO all during your ownership! Buy with *confidence*. Sold only at the best dealers!

COMPLETE *with* BUILT-IN MOTOR, *$19.95. If Dealer hasn't it, send $19.95 we'll ship postpaid.*

SYNCRO QUALITY ELECTRIC TOOLS

SYNCRO CORP., Dept. G-120, Oxford, Mich., U.S.A.

Does Difficult Jobs Like Magic

He'll be more than delighted with this all-purpose tool that packs a world of power. You've never seen such gripping . . . LOCKS to work with more than Ton-Grip. Only the Genuine VISE-GRIP has these features: **Involute Jaw Curve** holds all shapes. **Knurled Jaw Tips** won't slip. **Thin Nose, Super Wire-Cutter.** With cutter—No. 7W, 7", $2.25; No. 10W, 10", $2.60. Without cutter—No. 7C, 7", $1.95; No. 10C, 10", $2.25. No. 7, 6", $1.85; No. 10, 10", $2.15.

Order from your dealer

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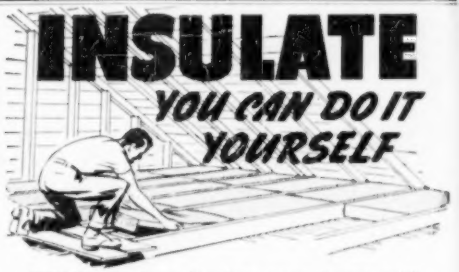
Dept. M-12 **DeWitt, Nebraska**



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Precision made of tool steel. Hardened tips on all six measuring rods. One ½" spacer. Chrome finish. Complete with case. **$6.95**

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We have been awarded 100,000 fancy briar pipes by Quartermaster Corps. Assorted shapes and sizes. All popular makes. Buy now for Christmas Gifts. Set of 7 **$3.50**

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Chrome plated, precision engineered and carefully tooled to give long life. All new.

0-1" capacity . . . each **$2.25**
1-2" capacity . . . each **3.50**
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Spiral Flute. Mfd. by Alvord Polk Tool Co. **All New,** original pack. 1/4" - 3/8" - 7/16". Recommended expansion limit, .006". Original value $12. Set of 3 . . . . . **$4.95**

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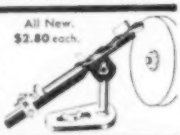
All New. **$2.80** each.



Sharpens round, square or tapered drills up to 6" long. Even an amateur mechanic can get a new, factory finish on a drill in 25 seconds. New protractor feature gives every drill sharpening angle, with 5 convenient angles already marked off. Usable with hand or power stone. A brand new development, manufactured by Ten Eyck. Shipped postpaid

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FREE **Full Details SEND TODAY**

Want the Pure Stuff?

(Continued from Page 244)

York rare-minerals dealer plans to try to prepare pure hafnium metal.

Certain AEC subcontractors, the directory notes, are the only ones in the country able to roll thin foils of pure beryllium metal.

What the compiler would like to know, himself, is where his laboratory got two tiny cubes of solid osmium. Heaviest of metals, it's usually available only in sponge form. Since he can find no record of the cubes' purchase, he thinks perhaps a graduate student made them. At any rate, he'd like to get some more. END

Spray Sampler Tests Jet Efficiency

To HELP improve the jet engines that power our latest fighting planes, engineers at the Beacon, N.Y., laboratories of the Texas Co. devised this jet-spray tester. A fan of metal tubes is placed across the diameter of the fuel spray issuing from nozzle at the top. The amount of fuel hitting each tube end is collected and measured in graduated vials at the bottom. Fuel-spray characteristics also affect the efficiency of Diesel engines and oil furnaces.

Hydraulic Valve Lifters Need Best Oil

IN AUTO engines equipped with hydraulic valve lifters, the manufacturers recommend that you use only premium or heavy-duty oil, never the regular type.

Gasoline Engine Generators: HOMELITE

Gasoline Engine Generator—30 Volt DC 50 ampere (1500 Watts) generator driven by single cylinder, two cycle air-cooled gas engine approx. 3 HP. Rope or electric starting. From unused Govt. vehicles, reconditioned. Shipping Wt. 150 lbs. Order No. 1012..... **$59.50**

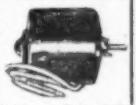
HOMELITE Gas Engine Generator—2000 Watts. Order No. 2012 $79.50

MAKE YOUR OWN ELECTRIC WELDERS

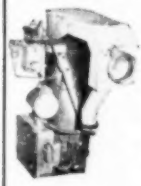
With P1 Generator—28 Volt 200 Amp. output. Govt. reconditioned. Shipping Wt. approx. 85 lbs. Order No. 3012..... **$24.95**

F. O. B. LIMA, O.

6 VOLT AC or DC MOTOR



Ideal for auto heaters, fans, defrosters, models, etc. Used by Govt. in aircraft. Shaft size: 1/4" x 7/8". Order No. 4012—Postpaid U.S.A..... **$2.00**



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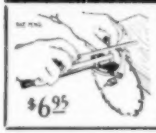

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2 HP	60 gal.	$264.00
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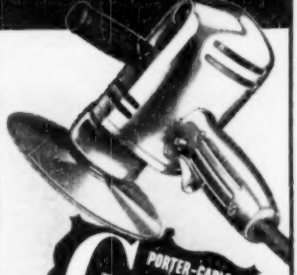

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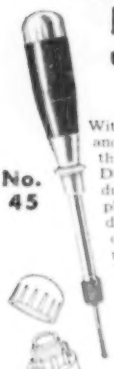

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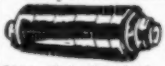

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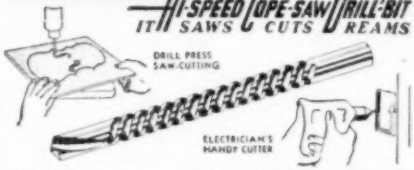

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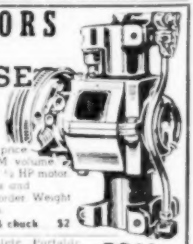

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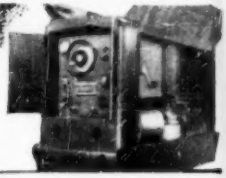

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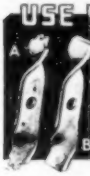

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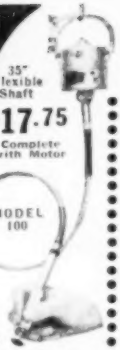

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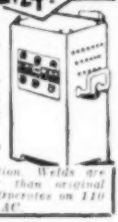

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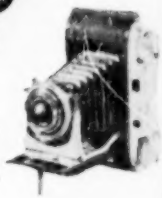

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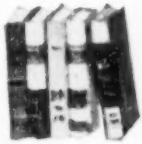

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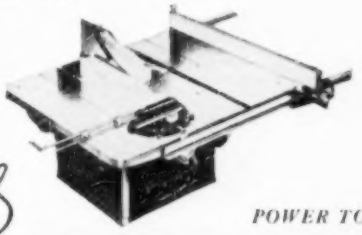

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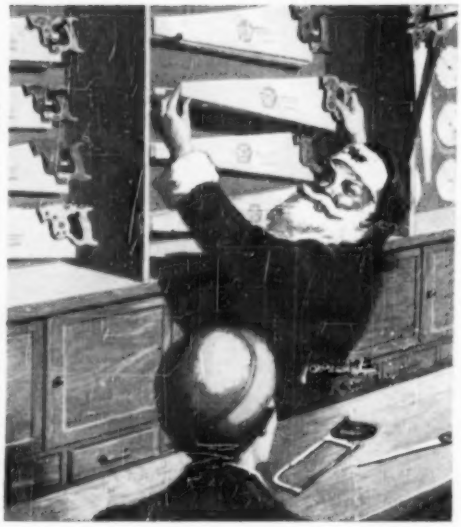
CHRISTMAS 1950

CHRISTMAS 1950



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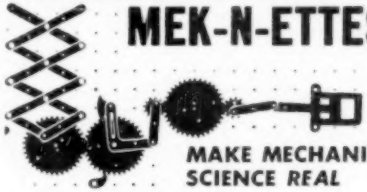

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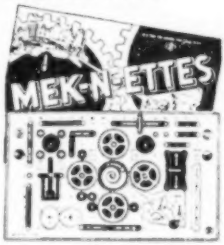

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America's first and most famous polisher-sander fits any 1/4" elec. drill. Complete with sheepskin bonnet, rubber pad, 2 sanding discs.

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NEW BULL SAW

Fits any 1/4" elec. drill. Powerful, portable, easy one-hand operation. Depth of cut: 1-1/8". Complete with saw blade.

New BULL "200" ELECTRIC DRILL

$16.50

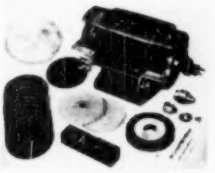
You'll never "stall out" with this portable powerhouse! WE GUARANTEE your MONEY BACK if it isn't more powerful than any 1/4" elec. drill at ANY price! Standard model, **$16.50.** (Model 200-J, with Jacobs geared chuck, **$19.50.**)

Sensational new

ZIP SAW

$39.95

A heavy-duty, perfectly-balanced, portable electric hand saw with full 6 1/4" blade. New, unusual features—miter gauge, depth gauge and rip fence! Mitres 2 x 4's at any angle—90°, 15°, 30°, 45°. Depth of cut: 2 1/8". Motor is 5200 rpm Universal AC-DC, 110-120 V. Beautiful Blue steel case, **$5.95** extra.)



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For sharpening, drilling, buffing, sanding, grinding, scraping, brushing and polishing **everything** around the home, farm or shop. Comes complete with motor, eye shields, rubber pad, assorted abrasive discs, bonnet, wire wheel, cloth buff, shaft and adapter, buff compound & 7" chrome alloy twist drills.

$19.95

Time's A-Wastin' & Good Tools are scarce! ORDER TODAY at these low prices and be sure of pre-Christmas delivery! Send cash, check, or M.O. **today!**

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CHRISTMAS 1950

WORLD'S SMALLEST RADIO $4.99!

made today. **Cigarette Pack Size—A Real Radio—Not a Toy! No tubes, batteries or electric "plug-ins" needed! Red plastic cabinet. Guaranteed to work** on local stations if used as directed or money back! **Use most anywhere you go!** *Should last for years!* **SEND ONLY $1.00** (bill, ck., mo.) and pay postman $3.99 C.O.D. plus postage or send $4.99 for p.p. delivery. **Complete** with personal phone and **Extra Long Distance Aerial Kit.** Wonderful Gifts. **Limited Supply on Hand—Order Now!**

MIDWAY CO., Dept. BPS-12 KEARNEY, NEBR.

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Build your own tree in hour. So simple to make. Worth 4 times the price of the kit. IDEAL CHRISTMAS GIFT. Kit includes: one ming tree (approx. 18" high, Chinese figurine, Natural Peruvian Moss (Grey), Lichen, Sand & Pebbles. Complete instructions with photographs.

$6.95 in natural moss
$7.50 in Green Moss

Sent postpaid or C.O.D. plus postal charges. Send for

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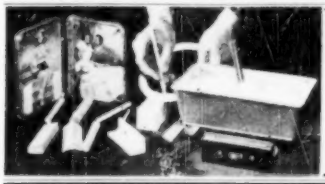

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Complete kit shown starts you at once! Rugged, all metal, U.L. approved, electric (AC or DC) heating unit (1 yr. guarantee) with pan, 85 supply of roll, tube & sheet plastic (colored & clear), 10 assorted forming blocks & dowels & complete instructions. Unit & pan alone only $9.95 p.p. Over 10,000 now in use.

15-day money-back guarantee. Send cash, check, M.O. $2 with C.O.D.'s. Order today for Christmas.

Complete Kit p.p. $13.95

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3 Year Service Guarantee

- ★ SHOCK RESIST.
- ★ RADIUM DIAL
- ★ SWEEP SECOND HAND
- ★ CHROMED CASE
- ★ LEATHER BAND

$6.95 Post-paid *Plus 70c tax*

Special! Order Now! Refund if not satisfied. Sorry, no C.O.D.'s.

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The Portable Belt Sander Attachment

For All 1/4" Electric Drills

The endless belt does any and all types of sanding—on any and all types of material—wood—metal—plastic—glass.

Ideal for hogging off, paint removal, or fine finishing. No pressure is needed because of built in adjustable pressure control.

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For faster—finer—finishing—simply chuck to your drill and handle like a plane.

Kit includes sanding belts, pressure control pads, booklet and guarantee. **Only $19.95**

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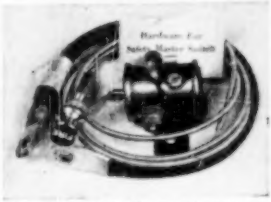

Give The Safety Master Switch . . .
ONLY $7.95

Here's a Christmas Gift any car owner will welcome . . . It Fire-Proofs and Theft Proofs the car by completely disconnecting the battery . . . Simply pull the Master Switch and the car is Safe from Fire and the car thief. Easily installed—Increases battery life.

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Electric STEAM ENGINE

First, SAFE ELECTRIC WORKING MODEL
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WHISTLES While It Works

Plenty of Power - Speed! Fun for EVERYBODY!

The dandiest performing steam engine you've ever seen. One filling of water, and it runs a full hour. Heated by electricity so no fire hazard to youngsters from matches, canned heat or alcohol lamp. A well made educational toy — 40-lb. pressure tested boiler is drawn from high tensile, cold rolled steel for extra safety—long life. Has counter balanced, machined crankshaft, a two-cycle piston, steam whistle and pop off valve. Nickel finish. Stands 8¾" high, works off standard 110 volt AC or DC current.

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Send complete Steam Engine as described above, complete with warranty. Postage paid.

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Lenk SUPERHEAT **Blowtorch** with the famous Gun Grip

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Home owner, amateur or skilled mechanic – he'll get a lifetime of pleasure and useful service from the LENK SUPERHEAT BLOWTORCH. It's the hottest, handiest, handsomest made, with its cool Gun Grip handle and gleaming chrome finish. Windproof. Operates at any angle. Exclusive built-in safety stand. Generates over 2700°, *500° more than any other blowtorch in its class*, and will do silver soldering, light brazing and sweat fittings. Operates on alcohol. FREE instruction booklet. *Money back guarantee.* THE IDEAL CHRISTMAS GIFT.

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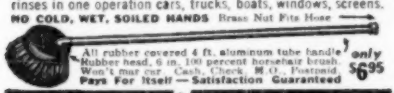
WHILE WEARING BEST CLOTHES. "Wash Faster" fountain brush, $10 value, turns work into pleasure. Washes and rinses in one operation cars, trucks, boats, windows, screens.
NO COLD, WET, SOILED HANDS Brass Nut Fits Hose



All rubber covered 4 ft. aluminum tube handle. Rubber head, 6 in. 100 percent horsehair brush. Won't mar car. Cash, Check, M.O., Postpaid. Pays For Itself — Satisfaction Guaranteed

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CHRISTMAS 1950

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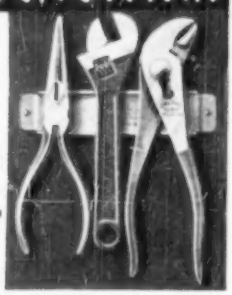
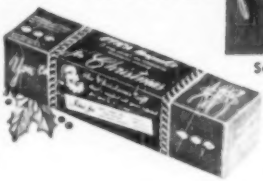
The Utica MagneKit with magnetic tool holder





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6" Long Chain Nose Side Cutting Pliers, 6" Adjustable Wrench, 7" Angle Nose Pliers—PLUS powerful Magnetic Holder.
ONLY $5.85.

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A fine set to own. A fine GIFT for any man who works with tools. There's someone on your Christmas list for whom the MagneKit would be perfect.

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It pays to buy UTICA *quality tools*

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1/3 Actual Size

Now . . . Measure Curved Lines!

Simply hold instrument vertically and trace line or distance to be measured. The index hand on the dial shows exact length of measured distance in centimeters or inches. (Multiply for feet, yards or miles.)

IDEAL FOR: Motorists, architects, draftsmen, designers, craftsmen, machinists, engineers, artists, photographers, teachers, students, decorators, hobbyists, layout-men, textile men, etc.

• Watch type. Has 2 faces—1 on front and 1 on back. • Precision made. • Highest quality material. • Chrome finish. • Unbreakable lenses. • Imported from Bavaria. • Comes in genuine leather sheath.

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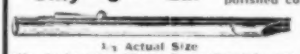

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An exceptional buy for Young and Old. A must for students, artists, layout-men, designers, hobbyists, shop work, decorators, draftsmen, contractors, carpenters, cabinet makers, surveyors, machinists, home inventors, or to anyone who has a plan or design in the making.

Contains:
• 5½ Reversible how pencil and pen. • 5½" Compass, with interchangeable pen, pencil and divider parts. • Extra 3 handle to use for either pen or pencil. • Spare lead container. • Thumb nail screw driver.

$3.95 ea.

Comes in lined—calco covered, 2 button snap case 8"x3½"x1".

Dealers and Salesmen inquiries welcomed.

10 day money back guarantee on any of the above items.

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Send check, money order, or C.O.D. to:

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. . . for Kids from 6 to 60
WEAR IT LIKE A WATCH
USE IT AS A RADIO!

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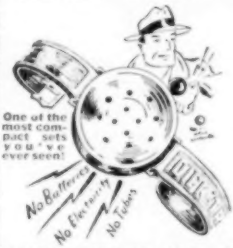

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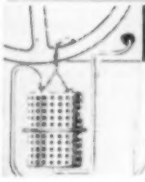

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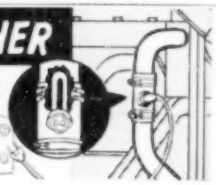

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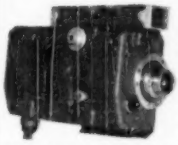
WAR SURPLUS INSTRUMENTS—RADIO—CAMERAS

16mm Bell & Howell MOVIE CAMERA

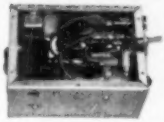


Uses standard 50' magazine film, color or black and white, F 3.5 anastigmat lens, elect. driven by compact standard battery pack. No winding necessary. Just push button & get finest movies possible. Mnfd. by Bell & Howell for U. S. Govt. at an original cost of $290.00 **NOW** **$29.75**

Completely converted for civilian use. Equipped with double image optical view finder, tripod bracket, battery case, exposure guide, push button control & steady grip handle. **ONLY** **$51.75**

Convert your own camera. We send free instructions and sell all accessories. It's easy, do it yourself!

MINIATURE COMPRESSOR



2 piston air compressor operated by 24 V series wound motor. Can be used AC or DC. Equipped with dual thermo cutoff for motor and compressor. Positive regulator 2 to 15 PSI. Popoff safety valve. Usable as vacuum or pressure pump. Ideal for jewelers, dentists, air brush work and aerating fish ponds. **NOW** **$10.95**

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Waterproof, shockproof, Type A-11 hack watch. 16 J black face, white numerals. Sweep second hand. Used by AAF. Built to exact specifications of U. S. Govt. Genuine War Surplus. State first and second choice as limited quantity available. **ONLY** **$19.75**

Add $1.98 Federal Tax

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24 volt AC-DC squirrel cage blower assembly with motor. Is ideal for darkrooms, ventilators and many uses. Easily convertible to 110 volts. Converted by us add $3.00. **OUR PRICE** **$2.95**

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Achromatic anastigmat 91.44 MM focal length. A 4-element projection system. Ideal for projectors, enlargers or cameras. Govt. Cost $55.00, **NOW** **$2.95**

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No batteries needed. Your voice generates current. O.K. for 25 miles. Perfect intercom for shop, office, farm, darkroom. WAR SURPLUS. Orig. Govt. Cost $58.00 ea., **NOW** **$10.95**

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DESK MICROPHONE

A precision built microphone, usable for intercom, P.A. systems, sound projectors, etc., **ONLY** **$2.95**

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Ideal Xmas gift for any kid. Metal frame. Bright yellow muslin covering. U. S. Navy. **ONLY** **$1.95**

PIN-ON FLASHLIGHT

Single cell, waterproof. Perfect for Boy Scouts or night fishing. **NOW** **29c**

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Govt. specification Head Sets. Leather bands. Used but guaranteed. **Only** **$1.29**

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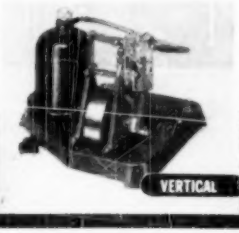
GENUINE MACHINED COMPLETELY ASSEMBLED STEAM ENGINE!

THE IDEAL XMAS GIFT

3 different Engines in One

WALKING BEAM

HORIZONTAL



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SAFE—STURDY—ELECTRICALLY HEATED BOILER

Let junior be a real engineer with this amazingly instructive toy. It's fun for dad too. Here is a steam engine so designed that it can be taken apart and re-built in three different ways. It's put together with machine screws—all parts die cast and machined to close tolerances. Built to last. No open flame. Electric current automatically shuts off when water boils out. Runs for half hour with one boiler filling. Order today. Only $7.95 complete post paid.

ONLY **$7.95** COMPLETE POSTPAID

Three blue prints of exploded drawings included giving simple assembly instructions for three basic types.

The K. J. MILLER CORPORATION
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The JIFFY metal CABINET

YOUR ANSWER TO SMALL ITEMS STORAGE at home, office, and shop (IDEAL GIFT, TOO)

So handy to keep nuts, bolts, screws, nails, parts, washers, stamps, hobbyists' needs, etc., at your fingertips.

THIS 32 DRAWER UNIT ONLY $8.95 POSTPAID

Stop searching, get a 32 or 64 drawer Jiffy to keep those small items that usually get mislaid. Spot welded steel, gray enamel finish, metal drawer guides. Dividers included with aluminum drawers make possible three compartments per drawer. Looks good anywhere. Send check or money order, please—no C. O. D.'s. Prices below. Your money refunded if not satisfied. Dealers write for quantity discount.

SPECIFICATIONS	WITH ALUMINUM DRAWERS	NEW SPECIAL!
32 Drawer Unit 6" Deep 12¼" Wide 15¼" High **64 Drawer Unit** 6" Deep 25½" Wide 15¼" High **Drawer Size** 1¼" Deep 2¾" Wide 6" Long	**Dividers and Index Cards Included** One piece rustproof aluminum drawers for heavy service — good for work bench and industry use. **32 drawer - $8.95** **64 drawer - $15.95**	**ONLY $2.95** **8 DRAWER UNIT** (24 compartments) **16 DRAWER UNIT** (48 compartments) **$4.95** **Specifications** 6" Deep, 8½" High 8 Drawer 6¾" Wide 16 Drawer 12¾" Wide

Ohio orders add 3% sales tax.
Marproof Rubber Feet included with all cabinets
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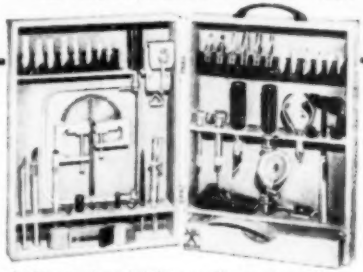
KAYTEE PRODUCTS, Dept. 5 . Box 588, Canton, O.

Great Gift! Great Buy!

"FORTY-NINER"

Complete set of X-acto Hobby Knives and Tools in portable wooden chest $25



Every knife, tool and blade in the famous X-acto line Precision made, easy to handle, joy of amateur and expert hobbycrafters. Other "big buys" in X-acto chests: No. 82 Knife Chest, $3.50; No. 86 Hobby Chest, $10.; No. 87 Tool Chest, $15. *(Prices slightly higher in Canada.)*

X-acto*

X-acto Crescent Prod. Co., Inc., 440—4th Ave., N.Y. 16
In Canada: Handicraft Tools, Ltd., Hermant Bldg., Toronto

BARRON Drill Press TOOLS

ROTARY WOOD PLANER $7.50 | 1" and 2½" DRUM SANDERS | ROTARY SURFACE SANDER $5.95 | $10.85 F.O.B. Detroit ALL-METAL DRILL PRESS TABLE

ALL-METAL SHAPER FENCE $9.50 F.O.B. Detroit

ROUTER & MORTISING BITS $10.50 set of six ⅛" to ½"

SHAPER CUTTERS $5.75 Inc. 4 Blades for Shaper or Drill Press

15 ESSENTIAL WORKSHOP OPERATIONS . . .

You can convert any standard make drill press into your most versatile, useful, low cost workshop tool. Barron Precision Tools now enable you to perform 15 indispensable shop operations—surface-plane woods and plastics — rabbet — tenon — panel — bead — groove — bevel — mortise — route — cut dovetail — sand surfaces and contours — shape — cut moldings—grind and buff. Over 200,000 Barron Tool users. Every tool sold on full 10 day money back guarantee.

FREE Workshop Guide & Catalog

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DYNAMIC Super Charged ARC-WELDER

LOWEST PRICED TRANSFORMER TYPE INDUSTRIAL WELDER

DOES WELDING, BRAZING, SOLDERING, CUTTING

This is one of the finest scientifically designed and precision-built genuine heavy duty transformer-welders on the market today! Made by an old established firm. High efficiency, heavy-duty output does work you'd expect from costlier machines. It's EASY TO OPERATE. Do in a jiffy by following the simplified instructions furnished. Works on iron, steel, brass, bronze, aluminum or other metals. OPERATES from any convenient properly wired 110 VOLT A. C. line. SAVE TIME AND MONEY . . . build or repair your own auto, home, farm, or shop equipment and appliances, etc. Make big money doing work for others in spare or full time. OVER 50,000 SATISFIED USERS all over the country, hobbyists, maintenance and repair men, farmers, tinsmiths, engineers, home and auto owners. Send coupon today for full details on 10-day trial.

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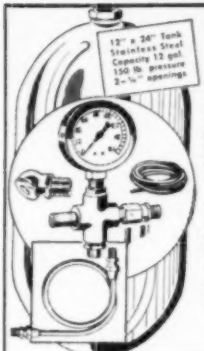
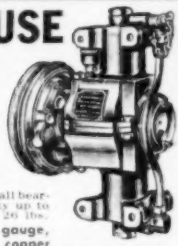


WESTINGHOUSE Air Compressor



Reg. $60.50 . . . Only

Model T-1 Brand New — 2 CYLINDER PISTON TYPE **$21.50**

Operates with ½ H.P. Motor or equivalent gas engine.

Compressor has 2" bore, 1½" stroke, ball bearing, 3.27 CFM at 600 R.P.M. Capacity up to 6.54 CFM. Size 9"x11⅞"x6⅝". Wt. 26 lbs.

Compressor, pressure tank, air gauge, air chuck, 20-ft. hose, pop valve, copper tubing with 4 brass flared fittings for connecting compressor to tank, 4-way cross and 3 nipples.

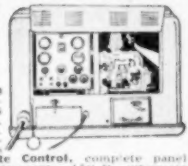
COMPLETE OUTFIT, wt. 52 lbs. **$32.50**

EQUIPMENT LESS COMPRESSOR, $12.50
COMPRESSOR SEPARATELY, $21.50
TANK ONLY, $5.95

LIGHT PLANTS

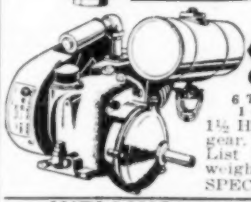
Brand New! War Surplus

Signal Corps Power Unit PE 197



115 volt 60 cycle A.C. single phase 5 K.W. Hebart, water cooled, 14 h.p. 4 cylinder Hercules engine. **Remote Control**, complete panel board with instruments, 150 ft. automatic remote control cable with reel. 150 feet #6 heavy duty wire with reel; housed in metal case with replacement parts and tools. Cable with reels alone worth $400. Regular price of unit $1000. Shipping wt. 1250 lbs. Our price, complete, f.o.b. Chicago **$895.00**

2½ K. W. LELAND POWER PLANT **$295.00**



Save 50% on GAS ENGINES!

RED SEAL CONTINENTAL

6 TO 1 REDUCION GEAR
1 CYLINDER—4 CYCLE

1½ HP with 6 to 1 reduction gear. Operates at 450 R. P. M. List Price $79.50. Shipping weight 54 lbs.
SPECIAL PRICE **$39.50**

AUTOMATIC COMPRESSOR UNIT

⅓ H.P. heavy duty capacitor motor, AC 110/220 volt, 60 cycle, 2x1¾ inch piston type compressor, splash feed lubrication, 12x24 inch tank, automatic pressure switch, CFM 2.8 at 100 lb. pressure, or 150 lbs. pressure for intermittent duty. Check valve, safety valve, air regulator with gauge and filter, 20 ft. air hose with air chuck for inflating tires. V. belt drive. Mounted on 2 wheels, ball bearing, with 2" x 10" pneumatic tires. Portable handle. Shipping wt. 90 lbs.

SPECIAL PRICE . . . $89.50

WELLWORTH V-BELT CLUTCH

Takes starting load off engines or motors. When speed is reached, a flip of handle shifts clutch from idling to driving position. Handles "A" belts. 2.35" pitch diameter. ¾" bore. Ideal for use with lawn mowers, garden tractors, home workshop motors, etc. 31¼" long. Safe, easy to mount, sealed bronze bearings, positive action. Shpg. wt. 3 lbs. **$7.50**

SAME CLUTCH FURNISHED WITH ¾" bore $8.50

Chicago Pneumatic Riveter & Chipping Hammer

CPAX Pistol grip handle. Takes up to 3/16" rivet. Weight 6 lbs. List price $73.00.

Brand new $22.50

WELLWORTH ZIP SAWER, JR. PORTABLE HAND SAW

Takes the work out of hand sawing

Convert your electric drill into a portable power saw. Light weight — easy to use with any ¼-inch electric drill or flexible shaft. Saw blade 4" diam. Maximum vertical depth of cut 1". Oil bearing lubrication. Oilite Bronze Bearing. Overall length 7½". Shipping weight 2 lbs. **$7.95**

½" Electric Drill *STREAMLINE DESIGN*

It's a Honey!

Universal air-cooled motor—110/115 V. AC-DC. Blower type fan for air cooling. Removable side handle for close quarter drilling. Jacob's Chuck with key. No load speed 450 RPM; full load, 290 RPM. ½" capacity in steel; 1" capacity in hard wood. 10 ft. cord and plug. Shipping wt. 11 lbs. Price only **$34.50**

Same drill furnished with Jacob's Hex chuck, only $29.65

U.L. Approved

PORTABLE ELECTRIC HAND SAW

The Zip Sawer With ALL the Features

6¼" Diameter saw blade, ½" square arbor hole. Maximum depth of cut 2⅛". At 45°, 1¾". Minimum depth of cut 0". Angular adjustment 90° to 45°. No-load speed, 5200 r.p.m. Full load speed, 3200 r.p.m. Amperes, full load, 8.0. Universal AC-DC motor, 110-220 volt. Dimensions: 11¼" long, 9½" wide (ripping guide removed); 7⅛" high (without blade). Furnished complete with 6¼" diameter combination blade and 10 ft. cord and plug. Wt. 11½ lbs. Price **$39.95**

"Wellworth" Blower *at a Bargain Price*

Quiet operating. Double wheel inlet, double width blower. For heating, ventilating, cooling, air washing, exhausting and forced draft. DIMENSIONS: 10" wheel; outlet 13⅛"x 11⅜"; inlet 8¾", Height 19". Width 18". Depth 16½"; C.F.M. ¼" S.P. 1600; outlet vel. 1[illegible]; motor ½ H.P. with overload relay; cord & plug, 110v. 60 cy. A.C. Ship. wt. 67 lbs. Special price **$42.75**

Blower Less Motor and Drive $27.50

Prices f. o. b. Chicago. Money back guarantee. Send check or money order today. Prompt shipment.

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Motor guide, air compressors, home and factory workshop tools, light plants, luggage bargains. Send 10c for postage.

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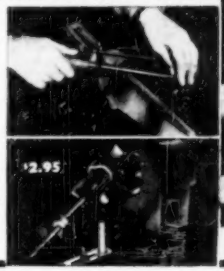
FILE YOUR OWN SAWS

Do expert saw filing at home. Precision filing easy without experience. Two simple adjustments. Keeps any hand saw extra sharp and true-cutting. Complete with file. Money back guarantee. Cash with order, prepaid. (COD postage extra.) Order today. **$2.95.**

GRIND YOUR OWN DRILLS

Sharpen 3/32" to 1" drills like an expert in 30 seconds. Precision lock insures factory accuracy. No experience necessary. Full instructions. Use with any hand or power grinder to keep drills extra sharp and true cutting. Guaranteed. Order Today. **$2.95** postpaid. (COD postage extra).



TINY PLANE WITH BIG GRIP

Pat. extension handle makes it as easy to Grip as a big one. Handy for small spots and all around fitting and finishing. 3¼"x1¼" face. Precision made. Blade guaranteed to hold edge. Cash with order Prepaid (COD Postage extra). Order today. Only **$1.50.**

ALL PURPOSE HANDLE

Speedcor Handle works like drill chuck. Holds files, razor blades, taps, drills, allen wrenches, bits . . . any shape shank—flat, oval or round. **101** uses. Positive, non-slip grip. Precision made. Fully guaranteed. Order Today. **$1** Postpaid.

The SPEED CORP., Dept. PS-12, 512 N.E. 73 Ave., Portland 16, Oregon

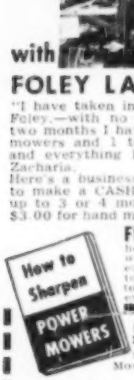
START A BUSINESS this quick way

with

FOLEY LAWN MOWER SHARPENER

"I have taken in 100 mowers in 5 weeks since I got my Foley,—with no advertising," says George C. Wise. "In two months I have sharpened 155 hand mowers, 6 power mowers and 1 trimmer. My machine has paid for itself and everything I take in now is all profit"—from Otis Zacharia.

Here's a business you can start in spare time, and begin to make a CASH PROFIT right away. The Foley handles up to 3 or 4 mowers per hour, and prices run $1.50 to $3.00 for hand mowers, $5.00 to $8.00 for power mowers.



FREE BOOK— "HOW TO SHARPEN POWER MOWERS" shows just how to sharpen any make of power lawn mower with the Foley. Prices **$97.50** to **$159.50**—easy payment terms available. Mail coupon today. We'll also send FREE PLAN telling how to start your own business without previous experience. No salesman will call.

FOLEY MFG. CO.,
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Send FREE BOOK "How to Sharpen Power Mowers," and FREE PLAN on lawn mower business.

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DUAL CROSS and ROTARY FEED

PALMGREN ROTARY, INDEX, MILLING TABLE No. 83

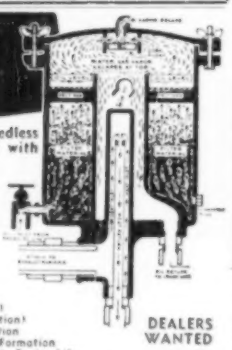
Has 8" table, 3x10" movement and 4" cross feed travel. Adjusting wheels and dials graduated in decimals and thousands. Scaled for tilting to table. **No. 83** Priced **$49.50. No. 82** without rotary feed **$39.75.**

Write for Circular No. 10

CHICAGO TOOL and ENGINEERING CO.
8396 South Chicago Ave., Chicago 17, Ill.

STOP CHANGING MOTOR OIL!

End this needless expense forever with



RECLAIMO Today's Most Advanced OIL RE-REFINING filter FOR CARS, TRUCKS, TRACTORS & DIESELS

Continuously cleans and RE-REFINES motor oil as you drive (by utilizing motor heat)—keeps oil in high grade lubricating quality at all times!

"RECLAIMO"
- REMOVES SOLIDS (by filtration)
- REMOVES WATER (by distillation)
- PREVENTS Excess Fuel Dilution
- PREVENTS Acid and Sludge Formation
- ADDS Thousands of Miles to Engine Life

MAINTAINS Stable Viscosity **ELIMINATES** All Oil Changes

FREE 32-PAGE BOOK "OIL FACTS" (with bona-fide $1000.00 offer on page 30), gives you the complete "Reclaimo" story and details of our extraordinary 90-DAY NO-RISK TRIAL OFFER! Write for your copy TODAY!

DEALERS WANTED

U. S. BUREAU OF STANDARDS, Bul. 86 States, "Oil does not wear out - mechanically."

MONEY-BACK GUARANTEE

Reclaimo Sales Div., Inc.
4508 S. Logan, Dept. S-4, Lansing, Mich.

SAVE UP TO 85% IN WAR SURPLUS

RADIO HAMS ATTENTION!
U.S. NAVY RADIO TRANSMITTERS #GP-7
AT A SPECIAL PALLEY PRICE!

Send on the following frequency ranges – from 350 to 9050 KCS. Here is the "chance of a lifetime" to own your own short wave sending station at a fraction of the cost of building or buying one. These sets are genuine U.S. NAVY equipment – Built by Westinghouse and used on big Navy Aircraft.

Set consists of the following:

...1 Transmitter-Rectifier Unit – operating on 120V.-AC, 600 – 800 Cycles and 14 or 28V.-DC... 2 Control Boxes... 6 Tuners in the following KC ranges 350 to 500 – 800 to 1500 – 1500 to 3000 – 3000 to 4525 – 4525 to 6500 – 6200 to 9050... Also 1 each Type 800 – 801 – 843 – 5Z3... 2 Type 1616 Tubes – 1 Pilot Control Box – 1 Operator's Control Box – and 1 Loading Antenna Coil.

Ideal for licensed Radio "Hams" – – Private Communications – Mobile Units – Aircraft, etc. Comes with complete operating instructions and test data. We made a terrific buy and we're passing it on to you as...

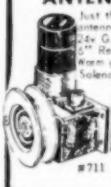
A PALLEY SPECIAL AT **Only 98.00**

K-21 AERIAL CAMERA

Equipped with 12.5 E.K. Aero Ektar 7" focal length Coated Lens. 24 Volt D.C. Electrically operated, complete with motor, cables, filter and carrying trunk. Lens alone is worth over $250.00 and can readily be adapted to 4 x 5 Press type camera. Don't miss this chance to own the "Pride" of professional color photographers.....

ARMY RE-ISSUE – CAMERA COMPLETE **$79.00**

ANTENNA REEL



Just the thing for tuning beam antenna. Powered by 1 S.H.P. 24v G. E. Motor. Removable 5" Reel. Limit Switch - Cam Worm gears. Bevel gear. Solenoid clutch.

Motor engaged to gear reduction only when electrical contact made. Operates in either direction. Ideal for auxiliary power take-off opening and closing doors, etc.

#711 **4.29**

ELECTRIC ACTUATOR

CTU-4

Leist No. 420A Linear Actuator. 24V.DC motor, 9000RPM. Approximately 1 SH.P. Drives actuator through a high reduction gear box, resulting in 4½" stroke in 12 seconds. Compression and tension loads up to 600 pounds. Has adjustable micro switch for limits of travel. Length retracted 14½"..... **8.95**

SHOE PACS

For long wearing – real protection – on all – weather friend! 14" boot with all leather upper – rubber shoe and sole. Has felt inner sole for warmth and comfort – A REAL BUY!!

3.95

Sperry Aircraft Directional GYRO COMPASS

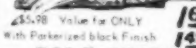
Dial is 360° swing calibrated 1-10° (6 min.) Panel Mount 4½" square with 3" luminous dial. Can be used in autos, planes, or boats by attaching one tube to intake manifold for required vacuum. Complete with reset caging knob. Gov't. overhauled – ONLY..... **$4.49**

HUNTING KNIFE

Has 6" Polished Steel Blade. Handle has leather grip – In leather sheath.

$5.98 Value for ONLY **1.69** With Parkerized black Finish **1.49**

BOLO KNIFE



10" x 2" Parkerized blade. 5" Gripped Handle. Weight 1¼ lbs.... Ideal for Hunting, Clearing Brush or Trails. With Case **1.19**

U. S. NAVY WINCH

Here's a real PALLEY BARGAIN. Designed to hold, pay out, and reel in steel cable used in towing targets. Capacity 2500 ft. 1/8" or 4500 ft. of 3/32" cable. Has gear driven rotating drum, brake band on drum, ratchet and pawl to set brake, detachable crank handle for rotating drum. Size approximately 29" x 13½" x 13"..... **27.95**

BATTERIES

A 9 Volt. Dry Cell unit. 3, wired in series will run a 24 or 27 Volt motor. Ideal for Lights, Boots, Portable Radios, etc. While they last.... **79¢**

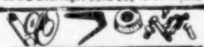
PALLEY SUPPLY CO
4321 SAN FERNANDO RD.
Dept. PS-72 GLENDALE 1, CALIF.

SEE AD ON OPPOSITE PAGE FOR TERMS!

WRITE TODAY for 1950 TOOL CATALOG 72 PAGES of BARGAINS in Machine tools (taps, drills, dies, reamers, etc.) Hydraulic Cylinders, Valves, Pumps, & Motors. Air Tools & Bearings. Send 25¢ to cover hndlg.

SAVE UP TO 85% IN WAR SURPLUS

Order from this Ad. All sales final. All Prices F.O.B. Los Angeles. Pay by M.O. or Check. P.O.'s Accepted from D & B. firms. ½ deposit with C.O.D.'s.



PALLEY FAMOUS MIXES!! Prepared especially for the HOME CRAFTSMAN, HOBBYIST, INVENTOR, GADGETEER or SHOP MECHANIC.

GADGET MIX – Rivets, Spacers, Bolts, Screws, Gears, Wheel bearings, Springs and Clamps. No. 106, 5 lbs. 1.19

BEARING MIX. No. 170A. Approx. 20 needle, Ball & Roller Bearings, New & Used. Sizes: 1/2" to 4". Some of these cost Gov't $10 a piece. Never such a value! 5 lbs. ONLY 1.59

HINGE MIX, No. 170H. 12 pairs of Strap and butt hinges, Hasps, 1" x 1" to 7/8" x 10" in length and 8" strap. 2 lbs. 1.09

ABRASIVE AND GRINDING WHEEL MIX – 50 pieces including honing stone, pencil rolls, wheels, etc. A sharp value. No. 170AG 99¢

SPRING MIX, No. 206 – Torsion, Compression & Tension Springs. Asstd. sizes. A treasure trove for emergencies. Scores of springs. 5 lbs. for ONLY. 1.69

RIVET MIX – 3 POUNDS – Consisting of sizes from 1/4" long to 3" long in many diameters & alloys. 1.19

FILE MIX – Ten assorted Files, 4" to 12", includes 3 Vixens, half rounds bastards, mills, etc., in seconds and upec but in good condition. 1 Vixen alone worth our price for entire mix. F-1 99¢

PULLEY MIX, No. PM-1 – You'll want this one around. 10 micarta & metal pulleys ranging from 1" to 5" with ball and one piece bearings. These are aircraft pulleys, the best made with 100's of uses. A WONDERFUL BUY!!! 2.95

COUNTERSINK MIX, No. 168. Wide assortment. Excellent condition. High speed steel. Assortment of ten 100° and 110° with pilot sizes ranging from 3/32" to 3/16" No. CM-1 2.69

SCREW MIX – 5 lbs. incl. 2½ lbs. wood screws & 2½ lbs. machine screws. All sizes. Save dollars and alway have plenty of screws on hand. . 1.39

NUT MIX NM-1 – 3 lbs. approx. 500 nut Anchor, Lock, Castle, Hex, Elastic Stop Nuts, etc. You'll always have plenty of Nuts in the shop. NM-1 1.39

SUPER COMBO MIX – No. SC2. Here's a real bargain. All eleven above mixes for ONLY 14.95

REAMER MIX – No. 168. Reamer assortment: Special Taper line finish Reamers. High Speed Steel. Slightly used but in excellent condition. Ten assorted sizes ranging from .168 x .165 & .244 x 215 to .425 x .385 & .432 x .403. One alone worth our selling price of ten. For set of ten Reamers . . . 4.49

AIRCRAFT CABLE

Rust resistant alloyed steel, extra flexible, pre-formed – 7 x 19 strand-on reels.

1/16" . . . . 3½¢ ft.	7/32" . . . . 7½¢ ft.
5/64" . . . 4¢ ft.	1/4" . . . . 9¢ ft.
3/32" . . . 4½¢ ft.	9/32" . . . . 10¢ ft.
1/8" . . . . 5¢ ft.	5/16" . . . . 12¢ ft.
5/32" . . . 5½¢ ft.	3/8" . . . . 13¢ ft.
3/16" . . . 6½¢ ft.	1/2" . . . . 16¢ ft.

Stainless Steel Cable

1/16" . . . 5¢ ft. 1/8" . . . . 14¢ ft.
1/4" . . . . 24¢ ft.

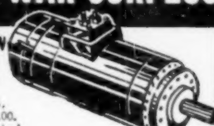
PIANO HINGE

Overall	Width	Length	Price Ea.
1¼"	(5/8" side)	72" alum.	$1.00
2"	(1" side)	9' alum.	$1.75
3½"	(1-3/4")	54" st. steel	$1.69

BRASS HINGE - 1¼" (5/8" side) .040 Any length at . . . . . 29¢ per ft.

PALLEY SUPPLY COMPANY
6321 SAN FERNANDO RD.
DEPT. PS-12 GLENDALE 1, CALIF.

NOW! MAKE YOUR OWN ARC WELDER



Here's a Real Buy! Finest precision built R-1. Generators, used on B-29's, cost the Government approximately $400.00. Gives from 300 to 400 amps at 27 volts. Ideal for all welding, light and heavy up to 5/8" thickness. FREE complete instructions for conversion of this Generator to welding unit. R-1 NOW AVAILABLE AT 17.95

Other AIRCRAFT GENERATORS

That can be made into Arc Welders.

P-1	27 Volts	200 Amps	15.95
1273-1A	27 Volts	75 Amps	12.95
E-5A	12 to 15 Volts	50 Amps	12.95
03	27 Volts	100 Amps	25.00

ELECTRIC ACTUATOR

Hundreds of uses for any mechanical device needing controlled 2-way action, opens, closes, raises or lowers doors, windows, gates, valves.

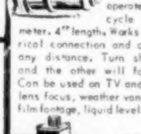
CTU-2 Foote Linear Actuator. 24 Volt A.C. or D.C., 8500 R.P.M., 1/6 H.P. Series wound motor, 4½" stroke in 13½ seconds. Compression and tension Loads up to 750 lbs. Adjustable micro switch for limits of travel. Overall length retracted 11" Only 6.95

MOTORS

LEAR ELECTRIC MOTOR. 24 volt, 6 amps, series wound reversible motor with overload clutch. Motor turns 11,000 R.P.M. Has 11 to 1 gear reduction box turning 1000 R.P.M. at take-off. Adaptable to flex or rigid drive. Limit switch box. Size 10" x 4". $7.95

DUMORE ELECTRIC MOTOR. Adaptable to rigid or flex drive, 400 R.P.M. at power take-off. Contains 1/25 H.P. 24 volt, 7½ amp reversible motor for indicating position. Has limit switches, magnetic brake, resistor to coordinate instrument. Overall dimensions 8½" x 4½" long. ONLY 7.50

G.E. GEAR HEAD MOTOR

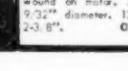


Heavy Duty G.E. Gear Head Motor. 1½ H.P., 24 volt DC, 125 amp reversible motor will drive reduction gear box unit 44.5 to 1, resulting in 168 R.P.M. at 5/8" diameter take-off shaft. Motor contains electro magnetic break.

UNIT COMPLETE 10.95 MOTOR 4.95

GEAR BOX ALONE 7.95

REMOTE INDICATING SELSYN MOTOR. Will operate on 115 volt, 60 cycle AC. 2¼" diameter. 4" length. Works on simple electrical connection and can be used for any distance. Turn shaft of one unit and the other will follow accurately. Can be used on TV and Ham antennas, lens focus, weather vanes, film footage, liquid levels, etc. 2.95 PAIR



SAMSELL MOTOR 27 volts, 16 amps. 1/5 H.P. reversible, series wound on motor. 3800 R.P.M., shaft 9/32" diameter. 12-spline. 4-1/8" x 2-3/8". ONLY 3.95

TWO HEAT SOLDERING IRON

World's Hottest Iron Value!

Two soldering irons in one with button heat control. Push the button—Select 150 or 300 Watt heat for light or heavy work. Complete with tip, bench holder, 5' asbestos cord. 110V AC. A $15.00 Value For . . . 3.95

RAWHIDE MALLET For working soft metal, or plastics, driving pins, etc. Weight 2½ lbs., metal collar with rolled leather insert head 1.09

UTILITY HAMMER For use as masonary chisel, stake driver, sledge, etc. Head special forged steel, sharp cutting edge. Handle is select hardwood. 1½ lb., 14" handle . 79¢ 2 lb., 21" handle . . 99¢

AUTO PULSE PUMP—Ideal for fuel pump for auto or boat. 24 Volt D.C. Can be adapted to 6 Volt D.C. 1/8" standard pipe ports 5.50

Sperry Aircraft Directional GYRO COMPASS Dial is 360° swing calibrated 1/10° (6 min). Panel Mount 4½" square with 3" luminous dial. Can be used in autos, planes, or boats by attaching one tube to intake manifold for required vacuum. Complete with reset caging knob. Gov't. overhauled – ONLY $4.49

AIR COMPRESSOR

High Pressure General Electric, 2 stage AC - DC. Rated pressure 1000 lbs. per sq. in. with 1/3 H.P. 27 volt, 7 AMP series wound motor with fan for cooling. Thousands now in use for spraying, inflating, laboratory use, etc. Can be adapted to 110 volt A.C. with transformers

A tremendous value at approx. 5% of orig. cost 27.50

TACHOMETER – Type C-9A. Operates on direct drive with flexible shaft. Range is 0 to 4500 RPM. Ideal for use on single engine planes or boats, autos, etc. Drives direct from cam-shaft or at 2-1 reduction from crankshaft. $14.75

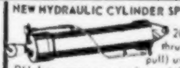
FIRE EXTINGUISHER

Kiddie Lux CO_2 Type. Built to Gov't spec. Shatter-proof, heavy case. Fully re-charged with horn

No. 602A – 7½ lb. $35 Value. 19.25
No. 603 – 10 lb. A $65 Value . . . 25.75
No. 605-A – 15 lb. New. Brush disc Type. A $75 Value . . . 29.75
No. 605-B – 15 lb. Wheel Control Type 32.95
No. 605-C – 15 lb. New. Squeeze Grip Type. $85 Value . . 39.95

Note: Weights listed are capacity extinguisher charge.

NEW HYDRAULIC CYLINDER SPECIAL



Gives 20,000 lb. thrust (push pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lb. thrust with 3,000 lb. line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1½" dia. piston shaft, 18" stroke, length 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road, farm & shop machinery, presses, etc. Cost Gov't $390.00 22.50

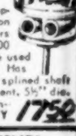
We carry the World's Largest Supply of New Hydraulic Equipment featuring over 20,000 Cylinders in 61 Sizes & Types. Can also supply all accessories such as Pumps, Fittings, Valves, Tanks, Hose Fittings. Let us solve your Hydraulic problems. Write for information.

2 SPEED PORTABLE MOTOR ENERGIZER. Used as auxiliary power source, to actuate starters or as principal power source. 1001 uses as high speed drill motor, power booster, etc. Has governor, 50 ft. electrical cable. Length 34". Power – 110-115V – 60 cycle A.C. or D.C. 27.50

Vickers Hydraulic Transmission

Self contained, 2 H.P. constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever) supplying piston hydraulic motor. Automatic pressure, dash pot for smooth control. Power output R.P.M. - 0 to 1/3 input R.P.M. in both directions. Input R.P.M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R.P.M. Ideal for Lathes, Duplicator Setup on Mills, Conveyors, Small Cars, Drives, Gearing, etc. Includes 2 4" Spline Shafts for input & power take-off - Cost Gov't. approx. $400. 25.00

Hydraulic PUMPS



Logan Gerotor type. For operating hydraulic systems on trucks, tractors, etc. Delivers 8 GPM at 1200 RPM, at 1000 PSI with 5 HP. Can also be used as Hydraulic Fluid Motor. Has 3/8" stand pipe ports, ½" splined shaft for pulley or direct attachment. 5½" dia. by 7" long. Used, but condition guaranteed. ONLY 17.50

VALUABLE GEAR BARGAINS

6 to 1 with screw shaft #111 . . . . $4.98
85 to 1 (can be used for radio, antennae, etc.) $3.95

GEAR BOXES VTG-1 – 90°, bevel gear 1½ to 1 reduction, size 7" x 6". A Life-time Value. $3.95

VTG-2 – Inline spur gear 16 to 1 reduction, thru 4 gears. Final take-off 4½" dia. 26 tooth. ⅛" Alum. spur gear. . . $6.49

Both above gear boxes have lever control for engaging & disengaging positive clutch. Dust proof housing. Prelubricated bearings. Both can be adapted to Vickers Transmission.

ELECTRONIC TRANSMISSION GEAR TRAIN

GT-1, approx. 50 Bronze Spur & Pinion Gears – 3/8" to 4" dia., 5 sets of 7 cluster gears, 2 complete worm and worm gear drive sets, 40 N.D. ball bearings ½" to 1½" dia., watch springs, bushings posts, face plates, housings—Micro Switches, 2 miniature controlled clutches, etc. Gears in multiple size & sequence, identical teeth ratio, giving 100's of gear reduction combinations. $8.49 Wt. 19 lbs. . . . .

Repair Bills?
NOT IN MY HOUSE!

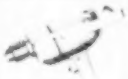
Fix doors, cabinets, furniture
. . . quickly, easily with

SKIL Home Shop Tools

Make your leisure hours pay *in money and fun* with SKIL Home Shop Tools. They take the work out of heavy jobs, speed ordinary repairs and household chores.

SKIL Home Shop Tools are quality-built by Skilsaw, Inc., for 25 years leading maker of portable electric tools for industry. Specially designed for general use in homes, on farms, in hobby work. Priced so low they pay for themselves on a single job! *At your favorite dealer's now!*

SKIL Home Shop ¼" Drill Light, streamlined, powerful.
Model 518 (with hex key chuck) . . . $19.95
Model 549 (with geared chuck) $22.95



SKIL Home Shop Drill Kit SKIL ¼ inch Drill and accessories for drilling, sanding, and countless other jobs. Complete $41.45

SKIL Home Shop ½" Drill For heavier drilling in wood, metals.
Model 522 $39.95
Model 542 $43.45

ASK YOUR DEALER ABOUT THESE OTHER SKIL HOME SHOP TOOLS

SKIL Home Shop Belt Sander • SKIL Home Shop Saws • SKIL Home Shop Saw Table • SKIL Home Shop Bench Stands • SKIL Trimmer— *The electric hedge trimmer*

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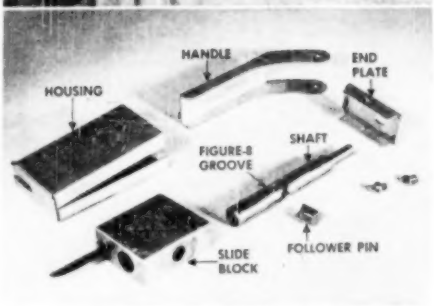

Hacksaw Unit Fits Hand Drill. A light, compact, low-cost hacksaw attachment that fits any ¼" electric drill or drill press now is being offered by the Bertram Engineering & Supply Co., of Kansas City, Mo. It weighs 11 oz. and costs about $5. With the handle folded to guard the blade, it measures 1" by 1½" by 4".

The 2-to-1 ratio of drill revolutions to saw strokes increases force at the saw teeth and prevents them from burning when used on metal. Wood, plastic, or metal up to ¾" thick may be cut with full chip clearance.

Here's how it works: The follower pin, set in the slide block, rides in the figure-8 groove in the shaft, moving the block back and forth as the shaft turns. There are no gears or bearings in the attachment. All moving parts are made of hardened, heat-treated steel.

Tools

Gas Torch Is Refillable. This propane-burning torch is said to reach a temperature of 3,660° F. One valve turns the torch on and off and also adjusts the flame. The burner can be quickly removed to attach to a refill cartridge. Otto Bernz Co., Inc., of Rochester, N. Y., prices the torch at about $20 with two burner tips; refill cartridges cost about $9.50 each. Compact, the cylinder is 2¾" in diameter and 11¾" long.

Screwdriver Has Four Blades. When folded up, this compact tool is only 4" overall and has no blades projecting to poke holes in your pocket. The four tool-steel blades handle screws from No. 1 to No. 14. For extra leverage, the blades can be set at 90° to the handle. The blades pivot on a solid rivet between the side frames. Shelton Plane & Tool Mfg. Co., Shelton, Conn., prices the tool at $1.50.

For the man or boy who loves fine tools. Always welcome, always appreciated . . . at prices to fit your purse. See them at your Starrett Tool Distributors.

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Since 1880 . . . Standard of Precision
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BUILD YOUR OWN TILTING ARBOR SAW!

SAVE $50 OR MORE

Exclusive GIL-BILT Build-It-Yourself Features

- No machining—build easily with hand tools only
- No blueprint reading—step-by-step pictorial plans, full scale patterns, actual photographs
- Sturdy wood, aluminum, and steel construction
- Capacity and performance of commercial saws selling for $60 and up

GIL-BILT 10-INCH TILTING ARBOR SAW

- 27x28 in. table, 13½ in. capacity in front of blade
- 10 in. blade cuts 3¼ in. deep, tilts full 45 degrees
- Floor model 34" high table always stays level
- New Departure ball bearing arbor, ¾" precision shaft turned down for ⅝" bore blades, alum. housing, shipped ready to run
- Jackscrew and 4½ in. dia. handwheel lowers and raises blade
- Cast aluminum miter gauge and self-aligning rip fence guide

GIL-BILT Metal Parts Kit includes Plans, ball bearing arbor, miter gauge and bar, rip fence guide, dado insert, lock knobs, jackscrew mechanism and handwheel, and all other metal parts (less blade) $20.95
Same Kit with 10" Combination Blade $24.90
Same Kit with 8" Combination Blade $23.90

GIL-BILT 12-INCH BAND SAW

- Cuts to center of 24 inch circle
- Handles stock up to 6 inch thick
- 18x18 inch table tilts 45 degrees
- Lower wheel and drive pulley runs on sealed New Departure Ball Bearings; Upper wheel runs on two ⅝" bore Oilite Bronze bearings
- Upper wheel tension and tilt mechanism of cast aluminum, completely assembled
  - Upper and lower blade guides. Each has ball thrust bearing, self-lub bronze jaws.
  - Rubber tired wheels. Choice of cast aluminum or make-your-own wood wheels on metal hubs
- Uses standard 58 inch blades up to ⅜ inch wide
- Fully enclosed mechanism for utmost safety

GIL-BILT Metal Parts Kit includes Plans, rubber tires, ¼ inch blade, hubs for wood wheels, ball bearing spindle, tilt mechanism, guides, table tilt segments and all other metal parts $16.95
Same Kit with two machined ready-to-install 12" cast aluminum wheels $20.95

Return Kits in 10 days for refund if not satisfied.
(Prices include postage within 600 miles. Over 600 add 5%)

Also available—Plans and Parts Kit for 8" Tilt Table Saw. Order Plans at $1.00 each—sent postpaid anywhere in the world or write for FREE descriptive catalog.

GILLIOM POWER TOOLS P. O. Box 1-VN, Lambert Field St. Louis 21, Missouri

Speed Way

SpeedDrills

Advanced designs, new all-die-cast (aluminum) construction and bigger motors. Lighter, handier, yet faster-drilling than more expensive, more cumbersome old style drills. Drill steel, wood, concrete or stone rapidly and efficiently.

See these new SpeedDrills before you buy; for more drill per dollar and more power per lb.

No. 400 ½" capacity—more power than drills costing almost double. Jacobs Geared Chuck, removable top handle. **$39.50**

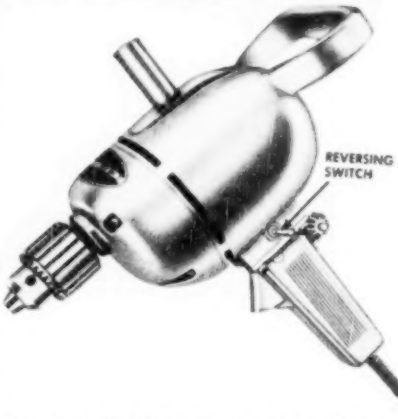
No. 79 ¼" capacity—power of ordinary ½" drill. **$22.50** With Jacobs Geared Chuck **$27.50**

No. 200 ¼" capacity. Fast-drilling with added power. **$16.50**
With Jacobs Geared Chuck. **$19.50**

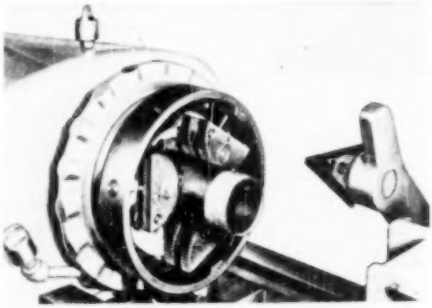
Write for Circular on drills, grinders and sander

Speed Way MANUFACTURING CO.
1864 So. 52nd Ave., Cicero 50, Illinois

New Tools



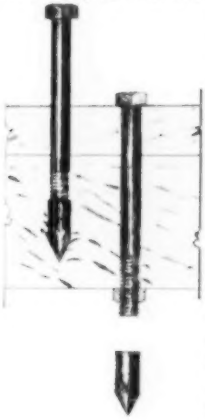
Electric Drill Is Reversible. Designed for deep boring in heavy timbers, creosote planking, and sappy or wet lumber, this ½" drill has a built-in reversing switch. According to Cummins Portable Tools, a division of Cummins Business Machines Corp., Chicago, this feature eliminates hand turning and difficulty in removing the bit from wood. Its capacity is ½" in metal and 1" in wood. The universal motor develops 550 r.p.m. without load. Price is about $48.



Chuck Is Self-Locking. With this wrenchless chuck—developed by the Peerless Machine Co., Racine, Wis.—you can rapidly chuck, release, or re-position round work from ⅜" to 2⅜" o.d. Work as short as 2½" can be gripped for threading at one end. No adjustment of the jaws is needed for gripping stock of different diameters. When the handwheel behind the chuck is turned, the three pivoted, toothed jaws grip and automatically center the work.

Impact Tool Turns Bolts and Screws. Twist this tool in the desired direction, rap it a few times with a hammer, and nuts, screws, or bolts can be quickly tightened or loosened. A cam principle turns the hammer impact into torque. H. K. Porter, Inc., of Somerville, Mass., sells the Impakdriver by itself or in sets with combinations of bits and sockets to fit various sizes and types of screws, nuts, and bolts.

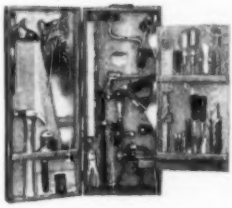
Bolts Hammered Through Wood. It isn't necessary to drill a bolt hole, it is said, when you use one of these pointed bolt adapters. You screw the adapter to the end of the bolt and hammer the bolt through the wood as though it were a nail. Then you unscrew the adapter for use with other bolts of the same size. The Model Patent Mfg. Co., Denver, Colo., sells them for $3.75 in sets, each containing four adapters of the following sizes: 3/16", 1/4", 5/16", and 3/8".



What better gift for man or boy!

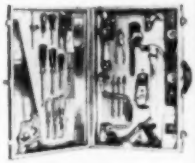
STANLEY TOOLS

Give them Stanley Tools. Preferred by skilled tool users . . . priced for everyone. Sold in chests and gift packages. See them at your local dealer's. Look for the famous trade-mark.



TOOL CHESTS

No. 910 Hobby House Set
29 tools in a roll-up oak chest



No. 895 Better Home Kit
28 Defiance Tools in metal cabinet

No. 888 Fix-it Kit
12 Defiance Tools in tote tray

GIFT PACKAGES

No. X200CM SCREW DRIVER SET. Four handy size drivers.

No. X610 Hand Drill. New style with enclosed gear.

Also available — 14 other gift-packed tools and 3 chests.

NEW EDITION Stanley Tool Guide only 25¢

All about the care and use of tools. 40 pages — 38 charts — 200 illustrations. Gives you the "know-how" on handling tools to make finished work more professional.

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Hardware • Tools • Electric Tools • Steel Strapping • Steel

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Enclosed is 25c. for the Stanley Tool Guide.

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P.S. Last minute news & notes...

ATOMIC ENGINE now being designed for the Navy is called "SIR" because it will be a "ship intermediate reactor." Atoms of its fuel will be split by neutrons. These will go faster than those used to maintain a chain reaction in most piles, but slower than the neutrons used in a bomb. Hence, their energies will be intermediate. General Electric has had a small "preliminary pile assembly" of this type running for 2½ years. A new method of controlling a nuclear reaction has been tried on this experimental pile and found to work "very well."

LUBRICATING OIL now can be fed to the bearings of industrial machines as steadily, automatically, and efficiently as electricity. Microscopic bits of oil are suspended in a stream of air. Like an electric motor that draws only as much energy from a power line as it needs to do its work, a bearing oiled with this mist picks up as much oil as it needs but no more. The Alemite Division of the Stewart-Warner Corp. has introduced this new system. It reports that one machine which formerly consumed from 12 to 15 ounces of oil a day has used only 1.5 ounces per day since it was put on an "oil mist" diet.

SPEEDOMETERS in many new cars have purposely been set to exaggerate a little bit more than those in prewar cars. When you go 29 m.p.h., your speedometer now may read 30, and when you go 90 it may show 100. Auto makers hope that the rising margin of error will result in less dangerous speeding on crowded roads.

TELEVISION SETS came off assembly lines almost as fast as cars this year. In the first eight months, U.S. produced 4,310,462 TV sets and 4,417,147 automobiles.

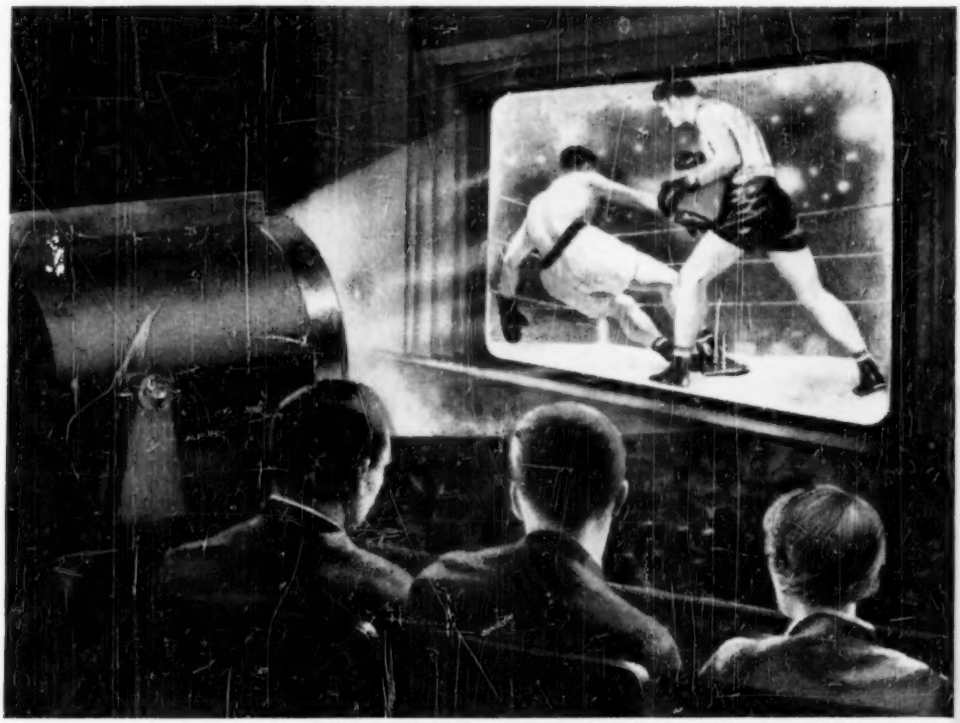
FASCINATED by the idea of establishing a permanent, self-supporting colony on the Antarctic continent, a number of young engineers and scientists have organized a nonprofit corporation to investigate the possibilities. Uranium and other resources might be found there and claimed for the U.S. in this way. So they wonder whether atomic, solar, or wind machines might not be developed to provide the pioneers with an abundance of cheap power. This, some of them say, might make feasible farming in underground caves, using fluorescent light.

RADIATION DETECTORS were being manufactured by only nine American firms in 1947, and they were turning out only 19 types. Now 84 companies are producing 180 different types. One new instrument is an electronic water monitor. It charts the radioactivity of water passing through it, and its makers urge that it be put in city pumping stations so that the survivors of an atomic bombing could be warned if water was contaminated.

THE WEST now appears to have been inhabited twice as long as eastern parts of North America. University of Chicago scientists have been checking the age of various bits of evidence--such as sandals found in caves--by determining how much radioactive carbon they contain. Their analysis of these clues indicates that human beings dwelt in Oregon and Nevada about 10,000 years ago but did not migrate to the Atlantic Coast until about 5,000 years ago.

DOCTORS are enthusiastic about a new drug called Asterol that helps cure athlete's foot. It'll be on the market this spring . . . MATCH BOOKS will soon have a new kind of striking surface that moisture will not damage . . . UPHOLSTERY in some '51 cars will be a new type of vinyl plastic that stretches in every direction and stays soft and pliable.

The Editors



New RCA Theatre Television System projects 15 x 20 foot pictures of television programs.

Giant size Television—"shot from a Barrel!"

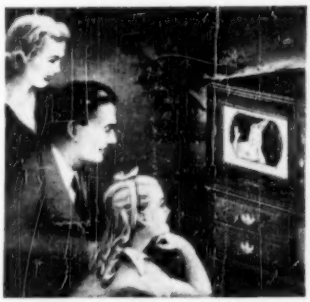
You've seen television. Now you'll see it in its finest form—giant projections of special events transmitted *only* to theatres on private wires or radio beams to make movie-going *better than ever!*

Success of the system comes from a remarkable RCA kinescope, and something new in projection lenses. The kinescope, developed at RCA Laboratories, is in principle the same as the one on which you see regular telecasts. But it is *small*—only a few inches in diameter—and produces images of high brilliance. These are magnified to 15 x 20 feet by a "Schmidt-type" lens system like those used in the finest astronomical telescopes.

Because of its size and shape, the new projector is referred to by engineers as the "barrel." It's already going into theatres, where you'll be seeing giant television—shot from a barrel.

* * *

See the latest wonders of radio, television, and electronics at RCA Exhibition Hall, 36 West 49th Street, N. Y. Admission is free. Radio Corporation of America, Radio City, New York.

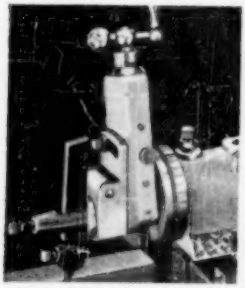


The same research which developed RCA's new theatre television system also gives you big, brilliant pictures on 1951 RCA Victor home receivers.

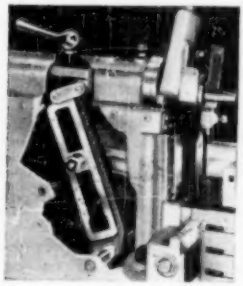
RADIO CORPORATION of AMERICA

World Leader in Radio—First in Television

SOUTH BEND 7" PRECISION SHAPER



Tool head locks in any position. Rugged clapper box also adjustable.



Rocker and crank with graduated eccentric adjustment for stroke.

Guards on all belts and pulleys. Quick-acting belt tension release.

Saves Time...Saves Labor

It's fast—accurate—easy to operate. The South Bend 7" Precision Shaper can consistently give you low machining costs on small parts. Designed to handle a wide variety of work in this class, it will enable you to release larger shapers for heavier work, save on machine investment and economize on both power and upkeep. Find out how this versatile shaper can give you better production, toolroom or maintenance machining. *Send coupon for literature.*

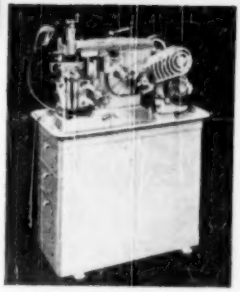
SPECIFICATIONS

RAM—Stroke length—0 to 7". Strokes per minute (4)—42 to 195. Cutting speeds—3 to 114 feet per minute.

TOOL HEAD—Vertical feed—3". Swivels—360°. Tool Post opening—13/32" x 7/8".

TABLE—Horizontal travel—9-1/2". Vertical travel—5". Power cross-feeds (6)—.002" to .012". Ram clearance—1/2" to 5-1/2". Table size—5-3/8" x 5" x 6-5/16".

VISE—Jaw width—4". Jaw depth—1". Maximum opening—4". Swivel base.



Steel stand for shaper—3 drawers and built-in chip pan.

PRICES

7" Precision Bench Shaper . . . $468
(Price includes light fixture, vise, drive unit with belt guards, motor pulley, V-belt, switches. Steel stand and motor extra.)

Steel Stand $137.50

Motor—1/3 h.p., 115 v., 1 ph., 60 cy., A.C. **$36.05**

Prices f.o.b. factory
Time Payments Available

SOUTH BEND LATHE
SOUTH BEND 22, IND. • *Building Better Tools Since 1906*

Send Information Checked:

☐ 7" PRECISION SHAPER ☐ LATHE ATTACHMENTS ☐ TIME PAYMENT PLAN

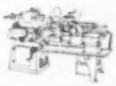
Name _____

Street _____

City _____ State _____

☐ 9" and 10" BENCH LATHES

☐ 10" to 16-24" FLOOR LATHES



☐ 1/2" and 1" collet TURRET LATHES

☐ 14" DRILL PRESSES

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FREE PROFIT PLAN

Are you tired of uncertain, monotonous, low-paid jobs . . weary of watching the other fellow pocket big, easy profits from your hard work? If so, be sure to investigate this amazing new Profit Plan for your success, TODAY. Cash in on the rich and waiting opportunity in this tremendous new field. Get in on the ground floor of a booming new industry. Start your own business at home, either spare or full time, and get ready to say "goodbye forever" to time clocks, insecurity, bosses and low wages. Exciting Profit Plan explains every step clearly and directly. Shows you exactly what to do, and how to do it!

FRE
BOOK
&
SAMP

PROFITS TO $5.00 PER HOUR AND MORE!

. . . easily possible with this new miracle finish. Some Operators make money within a few days. One man (see his letter on this page) received a $100 order less than an hour after receiving materials.

WOOD, FABRICS, METALS, PLASTIC — OR ANY OTHER SURFACE

toys

shoes or party slippers

jewelry boxes

BEAUTIFIES

. . . phonograph turn tables

radios

. . . auto dashboards

. . . auto trunk interiors —

lamps pottery glass

YOUR BIG OPPORTUNITY TO START A NEW AND PROFITABLE BUSINESS

This FREE booklet bri
Flok-Kraft's exciting ne
success. Jam-packed wit
that will amaze you —
story of profits to be mad
stores, garages, factories

Mr. Nels Irwin
President
Coast Industries

SEND NO MO
YOU TO EXAMI
WITHOUT RISK

NO PREVIOUS EXPERIENCE NECESSARY . . . THE WHOLE FAMILY

Flok-Kraft is fun to do, and families often "team up" to keep all the profits at home, instead of hiring outside help as the business grows. Anyone from 16 to 60 can learn quickly, through our

tested and prove
ous experience i
follow our simpl
can do top quality
a few hours.

HUGE DEMAND ASSURES STEADY PROFITS

There is no off-season in Flok-Krafting. In fall, winter, spring and summer, the demand is growing by "leaps and bounds" for this luxurious, velvety finish for radios, lamps, toys, store window displays, figurines, book covers, greeting cards, auto dashboards and trunk interiors — yes, even entire walls and ceilings of dens and playrooms. We show you how to go after orders like these, and hundreds of others as well.

GRASP THIS EXCITING AND UNUSUAL OPPORTUNITY TODAY

Everything possible has been done to help you investigate and take advantage of this great new Flok-Kraft opportunity. We will send you a FREE sample, FREE plan, FREE idea booklet — all without your risking a cent. Even the coupon at the top of the page is on the back of a postage-free, self-addressed post card. Fill it out, and take it to your corner mail box RIGHT NOW. Be first with the latest in your community!

NEW FLOK-K
$52.50 I

Dear Sir:
About ran out
low up North ca
interiors of the
Studebakers, six d
mat. Never heard
but he got my
down in the Sout
have worked for
come right up. D
3:30. Friday afte
fixed up. Got $5
trunk interiors —
$7.50 per trunk.

ACT NOW! SEND FOR FREE SAMPLE an

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et brings you all details of
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l with facts, plans and ideas
u — an almost unbelievable
made on orders from homes,
ories and many other sources.

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AMINE EVERYTHING
RISKING A CENT!

AMILY WILL ENJOY HELPING
proven methods, and previ-
nce is not important. Just
simple directions, and you
quality Flok-Krafting within

OK-KRAFTER MAKES
.50 IN 4 HOURS

n out of everything — a fel-
orth called me to flock the
the trunks on seven 1947
s, six door panels and a floor
heard of the man before.
my name from a fellow
e South end of town that I
d for and he wanted me to
up. Didn't get there until
y afternoon, but I got him
Got $52.50 for those seven
ors — about 4 hours work.
unk.

Very truly yours,
J.O.
Missouri

and DETAILS

les 15, California

EVERYTHING FREE!

MAIL THIS CARD TO . . .

COAST INDUSTRIES DEPT. 1C
1004 S. Los Angeles Street Los Angeles 15, California

Dear Mr Irwin

I'd like to have the FREE sample, and all the FREE facts about your Profit Plan which shows me how I may earn money at home with Flok-Kraft. This does not obligate me in any way Everything is FREE

NAME _____

ADDRESS _____

CITY _____ ZONE ____ STATE

Investigate

FLOK KRAFT TRADE MARK REG.

IT DOES NOT COST YOU ONE CENT!

COMPLETE DETAILS SENT FREE!

At no cost to you we will send full details showing how our plan can assist you in starting your own spare or full time business. We will also send you actual sample of FLOK-KRAFT Something you can see and feel. All that is necessary for you to do is print your name in the space provided above. Clip out the card on the dotted line and drop in the nearest mailbox. No one will call on you.

NO POSTAGE IS REQUIRED IF MAILED IN U. S. A.

CUT ALONG DOTTED LINES—OPPOSITE SIDE IS A POSTAGE-PAID MAILING CARD

READ WHAT OTHERS SAY ABOUT OUR PLAN FOR *YOUR SUCCESS!*

"Received the flok-kraft outfit and everyone that saw it is very enthused. I only had it about thirty minutes and got an order for a hundred dollar job Mr. C. H., Maryland

..."Getting orders for flocking faster than I will be able to handle them in spare time." W.R. Wyoming

....."I have received my order of Flok and Adhesives and believe me, I'm very pleased and happy as I've made myself MORE than the cost of my supplies already, and I've still got more jobs to do." Col. G. A. W., S. Carolina.

"I'm glad I sent for your course and only wish I had done so sooner. Things sure look brighter and better for me now." R. W. L., Ohio.

..."pleased with your course and I'm being swamped with work to do." W. F., Pa.

"I am kept busy every day with orders. I am very pleased with the results I get from your merchandise." K. G. M.

SEE OTHER SIDE

CUT OUT AND MAIL THIS CARD NOW

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(Sec. 34.9, P. L. & R.)

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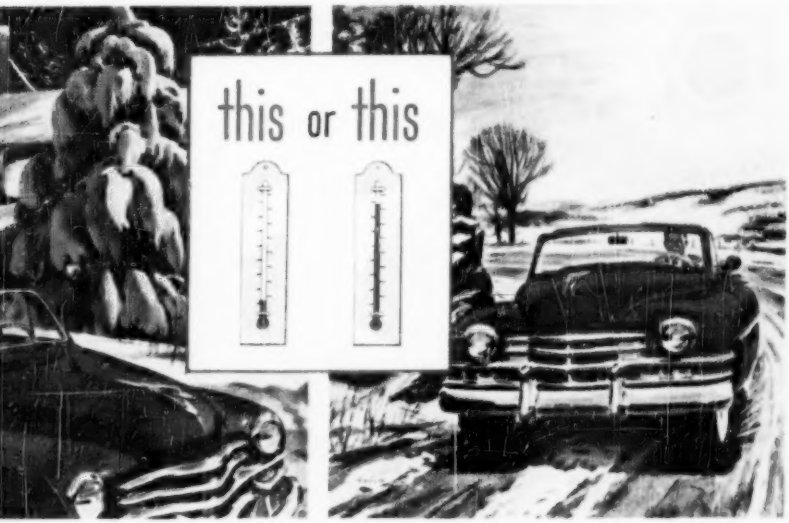

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One shot lasts all winter!

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